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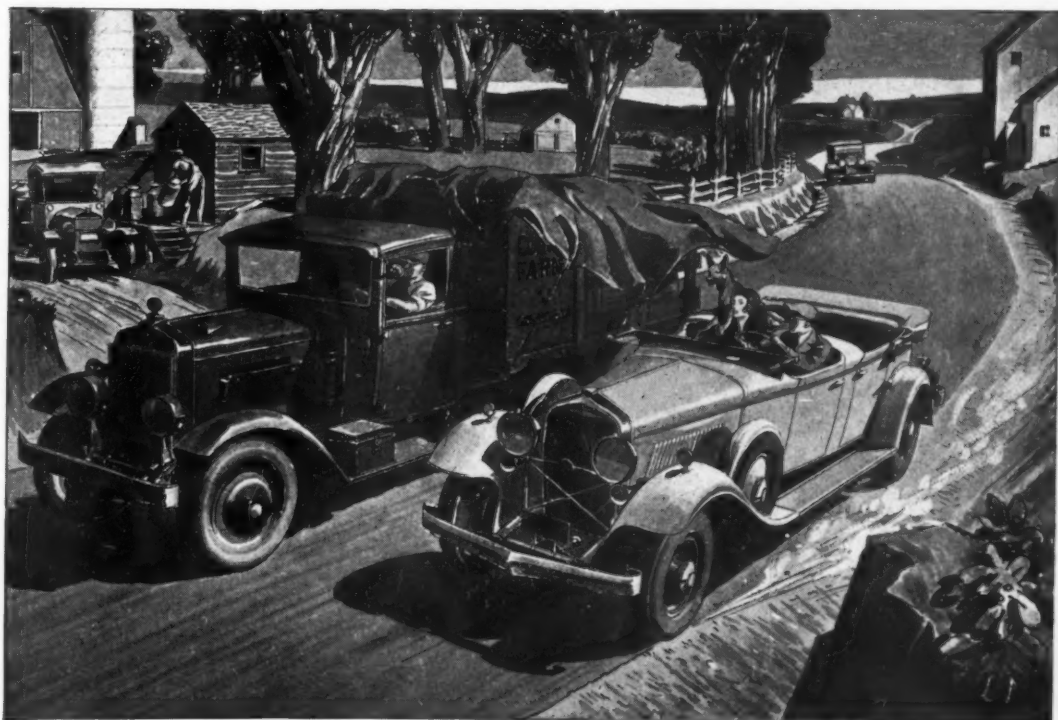
PUBLIC WORKS

CITY

COUNTY

STATE

"A few feet **W**ider means many years **L**onger"



When a road is widened from a two- to a four-lane highway its traffic capacity is more than doubled, and its life is lengthened by many years.

With Tarvia you can build a road wide enough in the first place—for less money than is often paid for narrow, ribbon roads.

A Tarvia program does not require your community to tie up a vast sum of money, or to build narrow roads to keep within its budget. Any hard surface road originally built too narrow can be widened with Tarvia economically and quickly, without detouring traffic. And, if your wide road

is all Tarvia, your investment will yield a maximum return from every square yard.

The Tarvia field man will gladly discuss the details with you. Phone, write or wire our nearest office.

The **Barrett** Company

New York	Chicago	Philadelphia
St. Louis	Minneapolis	Boston
Detroit	Cleveland	Birmingham
Buffalo	Columbus	Milwaukee
Providence	Syracuse	Cincinnati
Baltimore	Indianapolis	Rochester
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In Canada:

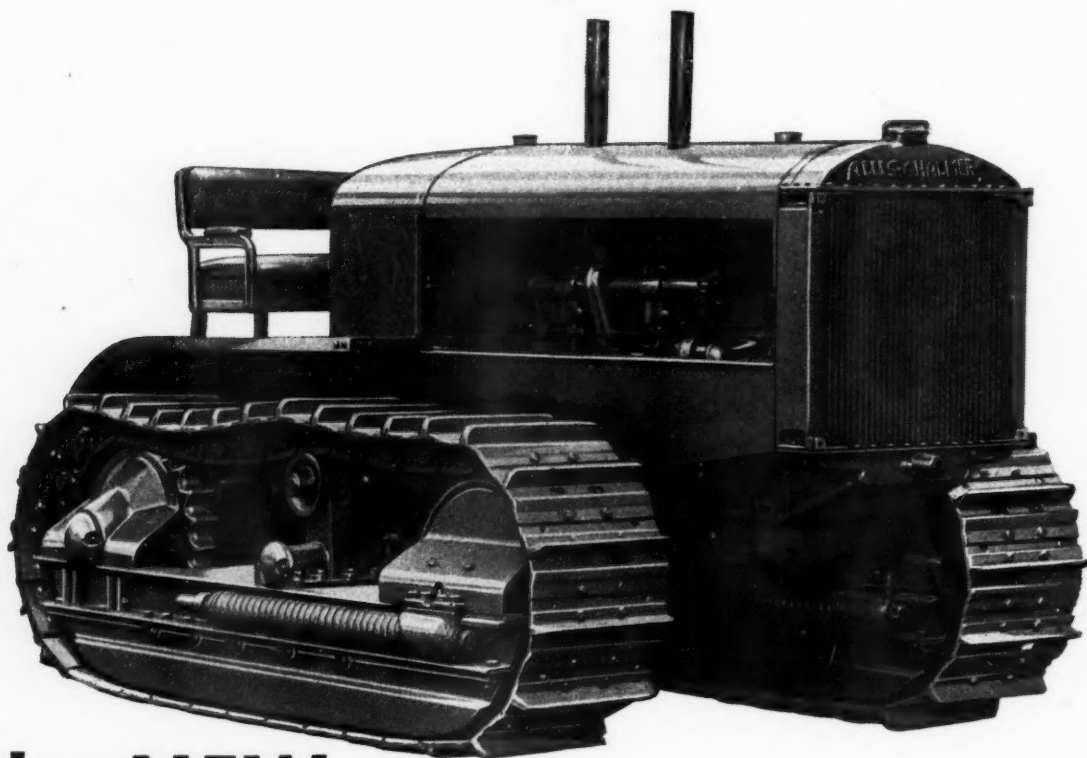
THE BARRETT COMPANY, Ltd.
Montreal, Toronto, Winnipeg, Vancouver

Tarvia
GOOD ROADS
AT LOW COST

DECEMBER, 1931

PUBLIC WORKS

6 SPEEDS - 6 CYLINDERS



in the NEW HEAVY DUTY FAST MODEL "L" TRACTOR

Think what it means on a dirt-moving job — in many cases three round trips from load to dump while other tractors make two — hauling more — moving more dirt on each single trip.

When you realize that Allis-Chalmers Model "L" Tractors have been in the toughest kind of service well over 4,000 hours — with practically no repair ex-

pense—you know they are built to last.

Consider these Model "L" features—
high road clearance, unit construction
— no frame or subframes, easy access-
ibility to all working parts, valve in head
engine and replaceable cylinder liners.

It's a knockout! Allis-Chalmers
Dealers are ready to show you—

Allis-Chalmers

MILWAUKEE, U. S. A.

TRACTOR POWER FOR EVERY PURPOSE

VOL. 62

Entered as second-class matter at the Post Office at New York, N. Y., Sept. 1, 1922, under the Act of March 3, 1879,
Published Monthly by PUBLIC WORKS JOURNAL CORPORATION, 310 East 45th St., New York, N. Y.
Subscription price \$3.00 a year. Single copies 35 cents.

DECEMBER, 1931

No. 12

DOWN WITH THE COST OF DIRTMOVING

*get equipped with
Blaw-Knox (Ateco)
Dirt Moving
Machinery*

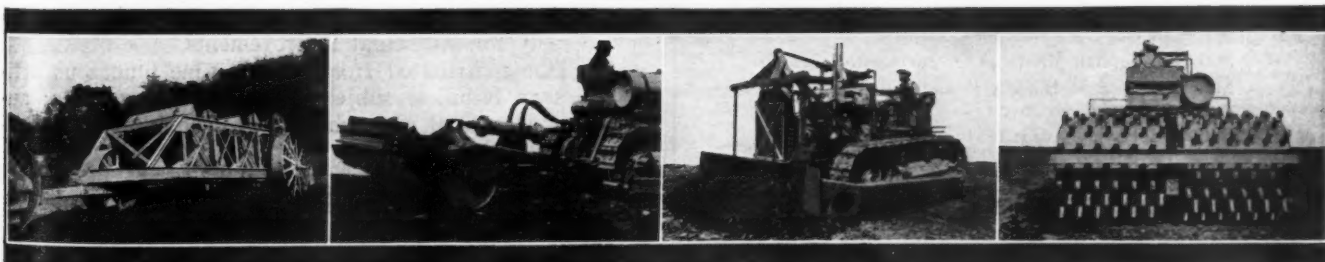


The Blaw-Knox (Ateco) HYDRAULIC SCRAPER completely disqualifies other types of scrapers on 90% of short haul dirt moving and grading jobs by *reducing former costs to a fraction.*

The HYDRAULIC SCRAPER is not designed for particular jobs—it *works effectively on any scraper job.*

It is not confined to one particular operation—it MOVES DIRT, GRADES, EXCAVATES, SHOULDERS, SPREADS, FILLS, COMPACTS, and can be used as a BULLDOZER.

The HYDRAULIC SCRAPER is hydraulically controlled by the tractor operator. It increases the output of tractor power and makes your equipment pay more dividends.



WAGON GRADER

SCARIFIER

BULLDOZER

TAMPING ROLLER

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BLAW



BLAW-KNOX COMPANY, 2019 Farmers Bank Building
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Send me complete information about the Blaw-Knox
Dirtmover and the complete line of Blaw-Knox (Ateco)
Dirt Moving Equipment.

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RETURN THIS COUPON

Warren-Knight Co., 136 N. 12th St., Philadelphia, Pa.
 Send me 64 page illustrated catalogue PW512 of Warren-Knight Transits and Levels.

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Give the best results
and greatest satisfac-
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8 Reasons Why...

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7. Easy Reading Graduations
8. Right Angle Peep Sight through telescope axle

You can prove it by accepting our 10 day Free Trial of any model Transit or Level—with no expense or obligation to purchase. Complete information in new catalogue.

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PHILADELPHIA, PA.



Warren-Knight
Precision Transit
Model No. 2-c

STANDARD

Asphalt Products

- Standard Cut-Back Surfacing Asphalt.
- Standard Asphalt Binder A for surface treatment.
- Standard Asphalt Binders B and C for penetration work (Asphalt Macadam).
- Standard Paving Asphalt 51-60 and 61-70 Penetration for the mixing method. (Asphaltic Concrete.)
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- Standard Refined Asphalt for sheet Asphalt paving.
- Standard Asphalt Joint Fillers.
- Standard Waterproofing Asphalt.

Specifications and all other particulars furnished on request.

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OF NEW YORK
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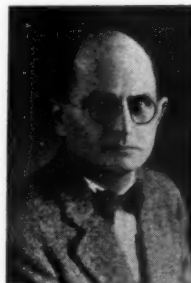


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With Our Authors



WARREN J. SCOTT is director of the Bureau of Sanitary Engineering, of the Connecticut Department of Health. We did not ask Mr. Scott for any historical data about himself because we wanted to put down here a few statements based on our own observation of his work. It has been a pleasure to everyone interested in sanitary engineering to note the marked advance in the scope, thoroughness and vision of the work of the Connecticut Bureau of Sanitary Engineering during the past few years. Unable to secure a large staff of assistants, he has so planned and directed the work, and has secured such excellent cooperation from local agencies and authorities, that the net results of his work have placed Connecticut high on the list.



HARRY TUCKER, professor of Highway Engineering, North Carolina State College of Agriculture and Engineering, was born in Amherst County, Virginia, in 1890; attended Washington and Lee University, graduating with the degrees of B.A. and B.S.; awarded the Professional Degree of Civil Engineer from the same institution in 1923. Began teaching in 1910 at North Carolina State College of Agriculture and Engineering, where he has been Professor of Highway Engineering since 1920.

Entered the National Guard as soon as the United States declared war in 1917 and served for over two years, eleven months of which service was in Europe as Captain of Engineers. Has been in private and consulting practice in Civil Engineering for over twenty years.

Member of the American Society of Civil Engineers; was first Secretary of the North Carolina Board of Registration for Engineers and Land Surveyors and later Chairman of the Board; Member American Society for Municipal Improvements.

Has contributed from time to time numerous articles on technical subjects to various magazines; author of several research bulletins; co-author of "History of 105th Engineer Regiment."

Other authors in this issue include THOMAS F. BOWE, well known consulting engineer of New York City; WALTER S. WHEELER, city engineer of Dover, N. H., who will be remembered for his correct solution of the Coconut problem in the June issue (page 17); C. W. GEIGER from out on the "coast;" JOHN R. DOWNES, who enjoys a very wide acquaintance among that group whose members talk the queer language of sewage treatment; D. Y. BATE (his picture will appear in the January issue); CLARENCE D. POLLOCK, veteran consulting engineer; MARK MORRIS; E. S. TISDALE, who has made a mark in West Virginia in sanitary engineering; CHAS. N. TUNNELL; and the ever-on-the-job JACK J. HINMAN, JR.

TO HELP YOU IN YOUR WORK, ANY OF THIS
INDUSTRIAL LITERATURE
WILL BE SENT **FREE** UPON REQUEST

It is a good practice to check this list regularly because descriptions of new bulletins are always being added.

Construction Materials and Equipment

Accessories for Motor Trucks

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities are described in a series of booklets issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 54-page booklet describes and illustrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools and their use in road construction. Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio.

9. Illustrated manual No. 11 describes "Hotstuff," the master oil burning heater. The only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. Use of and specifications for Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate. J. D. Farasey Mfg. Company, Cleveland, Ohio.

Asphalt Rollers

12. How to use rollers to save tamping costs. A 16-page booklet printed in two colors gives full details and also specifications of the Erie Roller. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

Bins and Hoppers

15. Steel bins and measuring hoppers are included in a fully illustrated catalog of Contractors Equipment issued by The Heltzel Steel Form & Iron Company, Warren, Ohio. Use the coupon.

16. Steel storage bins, measuring equipment for proportioning concrete aggregates, cement and water, ready-mixed concrete plants, truckmixing and agitator bodies are described in Catalog No. 1302. The Blaw-Knox Company, P. O. Box 915, Pittsburgh, Penna.

20. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Material Handling Buckets, showing the various types, sizes and uses for which they are intended and construction features and other valuable

bucket information. A complete catalog on all types of Material Handling Buckets will also be furnished on request.

Clamshell Buckets

27. Clamshell Buckets, showing the various types, sizes and uses for which they are intended, and construction features and other valuable bucket information. A complete catalog on all types of Clamshell Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

28. A 32-page catalog descriptive of all types of Blaw-Knox Drednaught Clamshell Buckets, illustrating various construction features and giving a complete list of type and sizes. Ask for No. 1234. A complete catalog on dragline buckets, No. 1247, will also be sent on request. The Blaw-Knox Company, P. O. Box 915, Pittsburgh, Penna.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully the subjects suggested by the title. A well-illustrated and instructive volume.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Published by the Solvay Sales Corp., 61 Broadway, New York, N. Y.

35. "A Report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Building Construction, Bridges, Culverts and Concrete Products." Concise practical data, embodies latest information on subject. Issued by Columbia Products Co., Barborton, Ohio.

Concrete Mixer

44. Concrete Mixers, both Tilting and Non-Tilting types, from 3½ to 84s size, with illustrated descriptions of all types mounting, power and loading equipment—64 pages published by The Jaeger Machine Company, Columbus, Ohio.

Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg. Co., Galion, Ohio.

Culverts—Large Diameter

59. The Culvert Handbook, containing 56 pages of typical culvert installations and much valuable data pertaining to all kinds of drainage problems. Toncan Culvert Mfrs. Assn., Massillon, Ohio.

60. "Large Diameter Corrugated Pipe," lists the advantages following the use of larger diameter culverts in meeting small bridge requirements. These are ease and speed of installation, economy, a full-width roadway and durable, maintenance-

free service. Armco Culvert Mfrs. Association, Middletown, Ohio.

Dirt Moving

61. A complete description of equipment and a valuable cost data on dirt moving. Bulletin No. 1310 descriptive of Blaw-Knox Dirt Moving Equipment including the Blaw-Knox "Ateco" Dirt Mover, the Blaw-Knox Wagon Grader, Scarifiers, Bulldozers and Tamping Rollers. The Blaw-Knox Company, P. O. Box 915, Pittsburgh, Penna.

Dump Bodies of Steel

70. Ford and other small truck body and hydraulic hoist equipment are described and fully illustrated in a technical publication. The Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

71. "Steel Dump Bodies." Full data on steel dump bodies for every type of hauling proposition and description of special "Self-Dumper Bodies" for road Builders. Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

Excavating Buckets

73. Excavating Buckets—shows the various types and sizes, the uses for which they are intended, construction features and other valuable bucket information. A complete catalog on all types of Excavating Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

Finishing Machines and Screeds

74. Asphalt and Concrete Finishing—Bulletin No. 6, completely describes the Ord Road Finisher and its application to the finishing of all types of concrete and asphalt pavements. The Blaw-Knox Company, P. O. Box 915, Pittsburgh, Penna.

75. High Speed Screeding and Finishing—the use of single and tandem screeds and tamper attachment for high speed production on concrete and bituminous pavements, city streets and highways—32 pages. The Lakewood Engineering Company, Columbus, Ohio.

Forms, Concrete

76. Steel Forms for concrete road, curb and sidewalk construction are fully described in a recent publication by The Heltzel Steel Form & Iron Company, Warren, Ohio.

Graders

77. "Blade Graders" is a 48 page booklet, recently published by the Caterpillar Tractor Co., Peoria, Ill., giving the complete details of the "Caterpillar" graders which are built to set new records in yards of earth moved, in miles of road maintained per dollar expended.

78. A 28-page bulletin describes the Austin 101 Leaning Wheel grader and its application for road construction and



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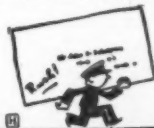
Please send me without obligation the following catalogs listed under INDUSTRIAL LITERATURE SECTION:

(Indicate by Numbers)

Name
12-31

Street Address

City



maintenance, heavy ditching and grading, bank sloping and scarifying. Austin-Western Road Machinery Co., 400 N. Michigan Avenue, Chicago, Ill.

Hammers, Selfpowered

82. A new bulletin describing and illustrating the wide adaptability of use of RODAX, a portable self-powered, gasoline driven hammer, has just been issued by the Rodax Corp., 2199 Lumber St., Chicago, Ill.

Hydraulic Hoists

85. "Dump Truck Hoist." Double the Truck's value by using power operated Hydraulic Hoists. Hydraulic Hoists for every make and model of Truck. Wood Hydraulic Hoist and Body Company, Detroit, Michigan.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Lanterns and Torches

90. Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. Catalog of interest in colors. R. E. Dietz Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1073 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket Elevators for different classes of work; and No. 1149, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, Philadelphia.

100. Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery. Link-Belt Co., Chicago, Ill. General Catalog No. 500.

Motor Trucks

106. "Operating Trucks Profitably in Contracting"—A 24-page survey covering thousands of motor fleets, with practical data on efficient truck operation and what to consider in selecting new equipment. General Motors Truck Company, Pontiac, Mich.

107. "Operating Records for Motor Trucks" is one of the most complete record books available. It includes the necessary forms and directions for a very accurate and detailed accounting of Motor Truck operations. Dodge Brothers Corp., Detroit, Mich.

108. Four-wheel-drive trucks increase the range of truck operation and are particularly adapted for economy of operation in road building and maintenance. A series of publications just issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Paving Materials

109. A 36-page booklet with 66 illustrations has just been issued by the Barrett Co., giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. Profusely illustrated with photographs, 24 pages. The Barrett Company, 40 Rector Street, New York.

273. Complete directions for surface treatment and bituminous surfacing with Cut Back Asphalt are contained in a 36 page data book just issued by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

Pumps, Contractors'

120. Diaphragm pumps in both the open discharge and the diaphragm force pump types. Self-priming centrifugal pump,

for automatic continuous prime on suction lifts up to 28 feet. Described fully and valuable practical information for contractors is given in special Bulletins #107-A and 1034. Ralph B. Carter Co., 53 Park Place, New York, N. Y.

Road Construction

121. "Road Construction and Maintenance" takes up such subjects as modern methods of handling large capacity equipment, tandem equipment, etc. A valuable publication for the contractor or road official. Cleveland Tractor Co., 1932 Euclid Ave., Cleveland, Ohio.

122. "Road Building Machines" is a handy reference booklet to the complete line of "Caterpillar" road machinery. 40 pages, illustrating the machines at work under many conditions. Issued by the Caterpillar Tractor Co., Peoria, Ill.

Road Machinery

125. The following publications cover a wide range of valuable and useful information on road-building machinery. Sixty Leaning Wheel Grader, the Super-Special Grader, the Motor Patrols, the Twenty-Planer, the Hi-Way Patrol Grader No. 3, the Ten Motor Patrol, and the Auto Patrol. Caterpillar Tractor Co., Peoria, Ill.

126. "Road Machinery." A sixty-four page data book describes road building machinery. Included in it are illustrations and descriptions of road graders, 5-foot blade to 12-foot blade road rollers, steam or gasoline powered, 3 to 15-ton single cylinder to four cylinder. Motor graders, three sizes. Scarifiers, Crushing plant equipment, small road tools. Special bulletins on each separate piece of machinery supplement the general catalog. Austin-Western Road Machinery Company, 400 No. Michigan Ave., Chicago.

127. "Road Machinery Illustrated." New illustrated bulletins on the motor rollers, three-wheel and tandem rollers, motor graders powered by Caterpillar, Twin City, Cletrac, McCormick-Deering and Fordson tractors, and straight and leaning wheel graders. Gallon Iron Works & Mfg. Co., Gallon, O.

129. An interesting booklet on Elevating Graders has recently been issued by the Caterpillar Tractor Co., Peoria, Ill. Illustrated, printed in 2 colors, it contains comparative specifications, tells of the construction and materials used, explains why they have the enviable reputation for capacity and for staying on the job.

Rollers

130. HERCULES, 6-cylinder road roller. Gasoline engine. Sizes 6, 7, 8, 10, 12 and 15 tons. Three speeds forward and backward. Illustrated catalogs and descriptive material. The Hercules Company, Marion Ohio.

131. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Erie Machine Shops, Erie, Pa.

132. A 32-page book in four colors featuring a complete line of road rollers. 8 3/4 x 11, leatherette cover, numerous action pictures. Buffalo-Springfield Roller Co. of Springfield, Ohio.

133. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers and their uses. The Buffalo-Springfield Roller Company, Springfield, Ohio.

134. "Road Rollers." Illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Gallon Iron Works and Manufacturing Co., Gallon, O.

135. 36-page, illustrated book describing the application of Motor Rollers to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

Sand and Gravel Buckets

137. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Sand and Gravel Buckets showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Sand and Gravel Buckets will also be furnished on request.

Sand and Gravel Washing Plants

139. Up to date information on portable sand and gravel washing plants with concrete capacities, ranging from 30 to 100 yards per hour.—Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

140. Seventy-page catalog giving complete information regarding Sand and Gravel Washing Plants, stationary and portable. Those interested in such equipment should have a copy. Link-Belt Co., Chicago, Ill.

Screens

141. Full information concerning shaker and revolving screens, conveyors, elevators, bins and chutes. Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Shovels, Cranes and Excavators

142. The Cranemobile, "successor to Trench Cranes," an adaptation of the crawler mounted Bay City Tractor Shovel is fully described and illustrated in Bulletin C2 issued by Bay City Shovels, Inc., Bay City, Mich.

145. 28 pages, 50 illustrations, action pictures and charts. Completely describes the light half-yard and the full half-yard convertible shovel, crane, dragline, trench hoe and skimmer manufactured by Bay City Shovels, Inc., Bay City, Mich.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines.

151. Lifting capacities and working ranges for the different sizes and types of the complete line of 1/2-yd. to 1 1/2-yd. shovels, cranes, draglines, ditchers and skimmers manufactured by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill.

Steel Posts

160. Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport Pa.

Surveying Instruments

163. A complete catalog and instruction book pertaining to the "Sterling" transits and levels are described and illustrated in a 64-page booklet which is now ready for distribution by the Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

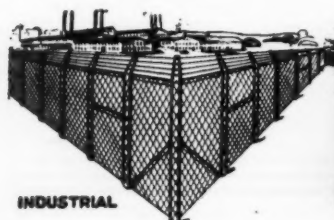
164. A 140-page manual of engineering and surveying instruments covering levels, plane tables, transits, current meters and supplies, such as hand levels, barometers, etc., is published by C. L. Berger & Sons, Inc., 37 Williams St., Boston, 19, Mass. (Also published in Spanish and in Portuguese).

Tires, Truck and Tractor

165. Speed and economy in use of solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Full information and data available from Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tractors, Crawler

169. The use of crawler tractors in roadbuilding and maintenance, earth



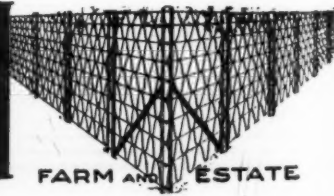
INDUSTRIAL

SWEET'S STEEL POSTS

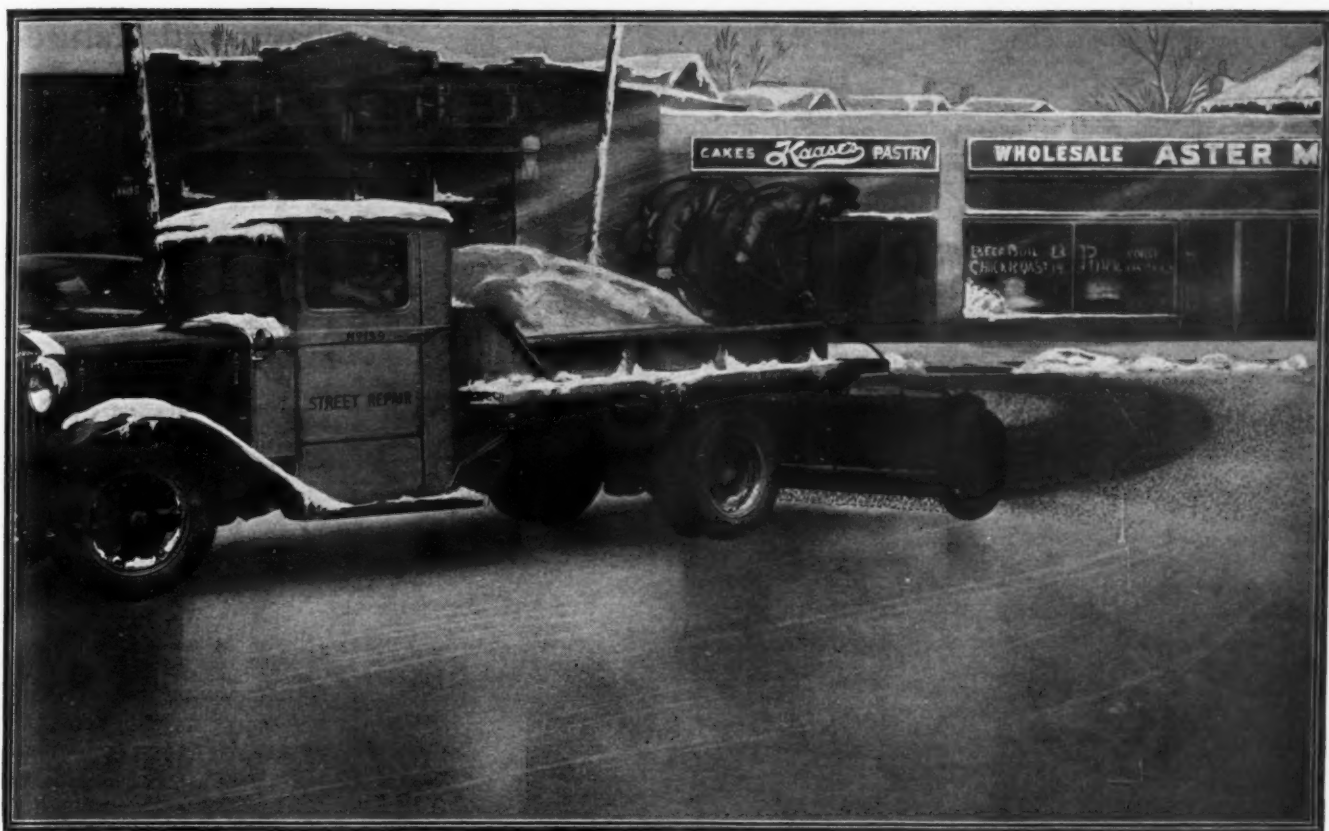
Rolled from the highest grade Carbon steel
--- easy to drive --- self contained --- with
pleasing appearance and high safety factor.

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SWEET'S STEEL COMPANY
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FARM AND ESTATE



Quick Traction for Glary Ice

WET pavements suddenly turn into veritable ice skating rinks with a few degrees drop in temperature. Motorists are caught unaware and before you know it a score of skidding accidents result.

This newly formed ice demands quick action. An ingenious maintenance official hit upon a method to provide quick traction. He loads up a truck with coarse sand saturated with Calcium Chloride and attaches his Calcium Chloride spreader, the same as is used in road dust prevention work in the summer. With this outfit he quickly spreads coarse sand saturated with Calcium Chloride over wide stretches of icy pavement.

This coarse sand with its Calcium Chloride coating melts just enough ice to dig in and anchor itself firmly, thus giving excellent traction. Wind or traffic

will not dislodge the particles as it does untreated materials lying loose on the top of the ice.

Many communities now place stock piles of cinders, coarse sand or gravel near hills and curves where they are always ready when the ice hazard arrives. Due to the Calcium Chloride these piles of tractive materials do not freeze and become unusable after rains and snows.

For removing an accumulation of ice, such as at frozen drains and culverts, flake Calcium Chloride spread on direct will quickly melt all ice. Further details on this interesting subject will be gladly furnished you. Just mail the coupon.

Calcium Chloride Publicity Committee

Mail the coupon to any one of these companies

Solvay Sales Corporation, 61 Broadway, N. Y. City
The Dow Chemical Company, Midland, Michigan
The Columbia Alkali Corporation, Barberton, Ohio

Without obligation please send complete details on the use of Calcium Chloride for providing traction on icy pavements.

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Address _____

**CALCIUM
CHLORIDE**
"makes Ice Safe for Traffic"

PW 12-31

moving, excavating, grading, snow removal, oil field work and lumbering. Made in "20," "30," and "40" and "100" sizes. Bulletin 562. Cletrac crawler tractors. Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, O.

171. The design, construction, details and complete specifications of the Ten and Fifteen models "Caterpillar" are given in a booklet published by the Caterpillar Tractor Co. of San Leandro, Calif., and Peoria, Ill.

172. The Caterpillar Sixty Tractor. This beautifully illustrated booklet tells the story of the Caterpillar Sixty Tractor design and construction. Caterpillar Tractor Co., Peoria, Ill.

173. Cletrac Crawler Tractors are built in a complete line ranging in size from the 12 h. p. model to the powerful 100 h. p. tractor. The Cleveland Tractor Company, 19322 Euclid Ave., Cleveland, Ohio.

Truck Cranes

182. Full-revolving, gasoline-operated Truck Cranes with a capacity of 7½-ton on a 10-ft. radius, for mounting on a 5-ton or 7½-ton auto-truck, are described in Bulletin 62, issued by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill.

Truck Hoists

183. "Dump Truck Hoists." Double the Truck's Value by using power operated Hydraulic Hoists. Booklet published by Wood Hydraulic Hoist and Body Company, 7924 Rlopelle St., Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

Road and Street Maintenance

Asphalt Heaters

201. Full data on tar and asphalt kettles, oil burning kettles, pouring pots, torches and hand spraying attachments. Connery & Company, Inc., of Philadelphia.

203. A 54-page booklet describes and illustrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools, etc. Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio.

205. The latest and improved style "J" Oil Burning Kettle for Paving Contractors, Street and Highway Departments. Connery & Company, Inc., 3900 N. Second St., Philadelphia, Pa.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance. It contains tables and composition, grading, etc.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

Dust Laying

213. Full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost. Solvay Sales Corporation, New York.

Highway Maintenance

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" describes fully the FWD truck and its economy for use in pulling road graders and maintainers—issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

218. "Maintenance Machines," a 32 page booklet, profusely illustrated, tells of the design and construction of "Caterpillar's" complete line of maintenance machines—3 sizes of motor patrols, a trailer patrol and planer—including machines to fit all pocketbooks and all road maintenance conditions. Issued by the Caterpillar Tractor Co., Peoria, Ill.

Highway Mowers

223. A new Motor Sickle Highway Mower, cutting from eight to twenty miles per hour, has been designed for mowing highways. Has a cruising speed while not mowing up to fifty miles per hour over smooth surface roads. Full details on construction and operation from Rawls Mfg. Co., Streator, Ill.

Surface Heaters

225. The new "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is fully described and its use illustrated in Bulletin 16 just issued by the Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Road and Paving Materials

Bituminous Materials

226. "Mixed - in - Place Construction." Step-by-step pictures and specifications for constructing road surfaces by Retread or Turnover methods. American Tar Products Co., Koppers Bldg., Pittsburgh, Pa.

227. "Asphalt for Every Purpose," a 44-page illustrated booklet describing Stanolind Asphalt products is now ready for distribution. Recently published by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

228. "Tarvia." An attractively illustrated 32-page booklet describing grades of Tarvia and showing photographs of actual application. The Barrett Company, 40 Rector St., New York City.

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material, cost, method of laying, life, etc. National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. A handy, useful volume, well illustrated. 47 pages, 5½x7½. The Dow Chemical Company, Midland, Mich.

Culverts, Corrugated

236. Culvert Handbook, containing 56 pages of typical Toncan Culvert installations and much valuable data pertaining to all kinds of drainage problems. Toncan Culvert Mfrs. Assn., Masillon, Ohio.

238. A 24-page, well-illustrated booklet lists the advantages that follow the use of Armco corrugated iron culverts and contains complete instructions for ordering and installing. Armco Culvert Mfrs. Association, Middletown, Ohio. Culvert Catalog No. 6.

Jacking Culverts

260. No interruption to traffic, and substantial savings in construction costs are the main advantages secured by using the Armco jacking method to install conduits, drainage openings, and passageways under streets, highways and railroads. "The Armco Jacking Method," describing this modern means of construction and its many applications, will be sent upon request, by Armco Culvert Mfrs. Association, Middletown, Ohio. Ask for Catalog No. 7.

Maintenance Materials and Methods

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control. It contains tables of composition, grading, etc.

273. Complete directions for surface treatment and bituminous surfacing with Cut Back Asphalt are contained in a 36 page data book just issued by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

Garbage and Refuse Disposal

304. The Holzbog line of sanitary wagons especially designed for low cost collection of wet or dry garbage and refuse is fully described and illustrated in a 16 page catalog published by Geo. H. Holzbog & Bro., Jeffersonville, Ind.

Incinerators

305. "Pittsburgh-Des Moines Incinerator," built and guaranteed by the Pittsburgh-Des Moines Steel Company, 3479 Neville Island, Pittsburgh, Pa., is described fully in a booklet sent on request.

Snow Removal

Snow Fences

347. A new folder giving full details regarding use and construction of the Mattson snow fence has just been issued by the Mattson Wire & Mfg. Co., Joliet, Ill. Illustrated in two colors.

Snow Removal

348. "Winter Maintenance" is the title of a booklet which illustrates many types of snow plows and methods of handling snow removal problems. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

349. "The Answer to the Snow Removal Problem." It gives full details of the new Frink type S snow plow for trucks. Carl Frink, Mfr., of Clayton, N. Y.

353. Efficient methods of combating quickly the snow menace on highways and city thoroughfares. Illustrates joint use of crawler tractors and standard and special snow plows. The Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, Ohio.

354. "Snow Removal Equipment" pictures various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action. Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill.

355. "Conquering Snow With Caterpillars." "An Unwelcome Visitor Is Coming." "A Wall Ten Miles High." Three publications on the snow problem by the Caterpillar Tractor Co., Peoria, Ill.

358. Complete data for selecting the proper size snow plow for your particular make and model of truck. Describes the new Type "S" Frink Snow-Plows and Frink Leveling Wings. Published by Carl H. Frink, Clayton, N. Y.

359. Gallon Iron Works and Mfg. Co., Gallon, Ohio, will gladly furnish details, prices and catalogs of their snow plows adaptable to any make of truck.

Sewerage and Sewage Disposal

Activation and Aeration

390. A booklet of value to sanitary and chemical engineers describes Norton Porous Mediums of bonded fused alumina (strong chemically stable, uniformly permeable) and their use in aeration of water and sewage. Norton Co., Worcester, Mass.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight are contained in an illustrated folder issued by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

403. An illustrated folder has just been issued by the Cochrane Chemical Co., 432 Danforth St., Jersey City, N. J., detailing the advantages and the savings in the use of Ex-XL-cell Sewer Pipe Joint Compound.

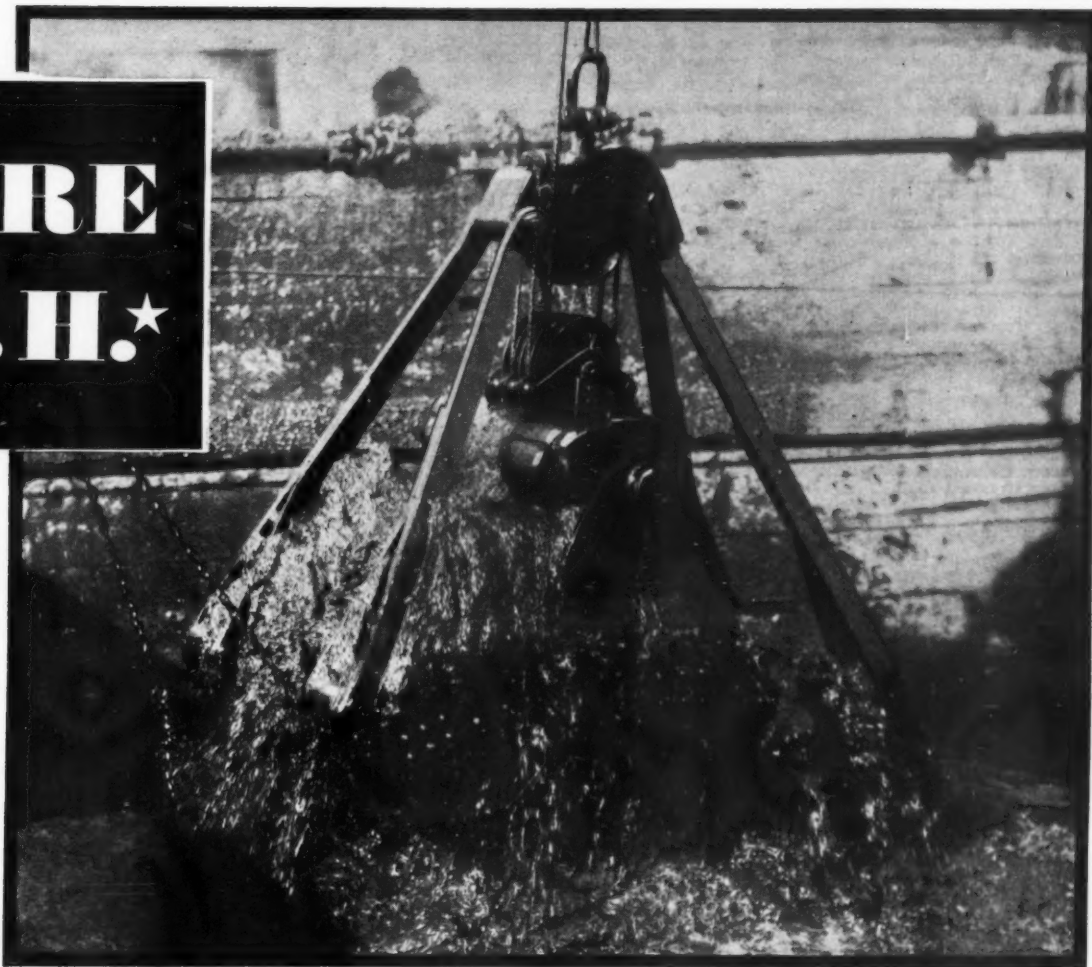
Manhole Covers and Inlets

404. Cast iron sewer blocks, ventilators, manhole covers and inlets, valves, etc., described in pamphlet by the South Bend Foundry Co., South Bend, Ind.

Pumps—Sewage

410. Non-clog vertical and horizontal sewage pumps and their characteristics

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are described and illustrated in bulletins of the Dayton-Dowd Co., Quincy, Ill.

411. Full information regarding sewage pumps is given in publication 210, and a large number of sewage pump installations are illustrated and described in publication 193. The American Well Works, Aurora, Ill.

Sewage Screens

414. The Dorr Co., 247 Park Ave., N. Y., publishes Bulletin No. 6391, which describes the construction and operation of the Dorco Mechanically-Cleaned Bar Screen.

415. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link Belt Company, 910 So. Michigan Ave., Chicago, Ill. Book 642.

Sewer Maintenance

416. Illustrated booklet describing Adjustable Turbine Sewer Cleaners, Self-Propelling Ferret Turbines, Drag Type Sewer Cleaners, Five Types of Sewer Rods, Conduit Rods, Windlasses, Sewer Braces, Sewer Cables. Turbine Sewer Machine Co., 5210 W. State St., Milwaukee, Wisc.

417. 16-page Price and Shipping Data Sheet No. A-31. These sheets give much supplementary information to that found in our Standard Catalog or Bulletin 120-A. The Price and Data Sheets with or without catalog sent upon request. Turbine Sewer Machine Co., Inc., 5210 W. State St., Milwaukee, Wisc.

418. "The Expanding Root Cutter and Sewer Cleaning Method," a 32-page booklet prepared by the Expanding Sewer Machine Co., Nappanee, Ind., gives full details as to methods and equipment needed for sewer cleaning.

Sludge Bed Glass Covers

420. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

Sludge Treatment

421. A new 48 page catalog dealing with Downes Floating Covers and Sludge Digestion Equipment has just been issued by the Pacific Flush Tank Co., 136 Liberty St., New York, N. Y. Catalog is very complete and includes interesting photographs of installations of floating covers and technical data on the subject.

Storm Sewers

422. A 24-page catalog, profusely illustrated with actual installations under widely varying conditions, which lists the features that give superiority to flexible corrugated metal construction for storm sewer installations, can be obtained from Armo Culvert Mfrs. Association, Middletown, Ohio. Ask for the catalog No. 5.

423. The Toncan Culvert handbook, containing 56 pages of typical Toncan Culvert installations and much valuable data regarding the use of Toncan Copper Molybdenum Culverts for economical and lasting storm sewers, drainage information, etc., will be gladly sent free upon request. Address Toncan Culvert Mfrs. Assn., Massillon, Ohio.

Treatment

425. Dorr Company, 247 Park Ave., New York, in its Sanitary Engineering bulletin describes the use of its equipment for treating municipal sewage, industrial wastes and water. Photos of numerous operating plants are shown as well as representative flow sheets illustrating the various methods of sewage treatment.

427. Eight separate catalogs on Sewer and Sewage Disposal Automatic Equipment, including pumps, Imhoff Tanks and Sewer Joint Compounds. These are of real value to the designer or operator of a treatment plant. The Pacific Flush Tank Company of Chicago and New York.

429. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link Belt Co., 910 So. Michigan Ave., Chicago, Ill. and Philadelphia.

430. The Dorr Company, 247 Park Ave., N. Y., publishes Bulletin No. 6171 which describes the treatment of sewage with Dorr Traction Clarifier an improved type of continuous sedimentation for use in water and sewage treatment plants.

432. The Dorr Company, 247 Park Ave., N. Y. C. publishes Bulletin No. 6481,

which describes the construction and operation of the Dorr Detritor for continuously removing and washing the grit from sewage flows.

Water Works Equipment

Activation and Aeration

465. A new booklet describing Norton Porous Mediums of bonded fused alumina (strong, chemically stable, uniformly permeable), the booklet will be of interest to all chemical and sanitary engineers. Issued by Norton Co., Worcester, Mass.

Hydrants

505. "Mathews" Fire Hydrants. Gate Valves and other water works appurtenances. 16 pages, 7 1/4 x 10 3/4. R. D. Wood & Co., Philadelphia.

506. Hydrants tapping apparatus, gate locks, valves and curb cocks described in a series of bulletins issued by A. P. Smith Mfg. Co., East Orange, N. J.

Joining Materials

515. MINERALEAD for bell and spigot water mains, G-K Compound for vitrified clay sewers, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Co., Mertztown, Pa.

Meters

520. 36-page booklet describes many valuable features in water meters including the chromium-shell gear train, patented frost bottom, ultra-simple design and other exclusive features. Bu a.o. Meter Co., 2920 Main St., Buffalo N. Y.

Meter Boxes

526. An illustrated catalog covering meter boxes and specialties such as gate valve housing, curb boxes, meter testers, melting furnaces, jointing materials, four-in-one pumps. The Hydraulic Equipment Co., Reading, Pa.

Pipe, Cast Iron

534. "Sand-Spun," Centrifugal cast iron pipe is fully described in a valuable 16-page 6x9 booklet, containing also complete specifications of this pipe. No engineer or water works official should be without this booklet. R. D. Wood & Co., Philadelphia.

535. "Data Book"—Cast Iron Pipe and Fittings, sizes 1 1/4 through 12 inches, either with or without Precaulked lead joints factory-made in the bells. The McWane Cast Iron Pipe Co., Birmingham, Ala., and Provo, Utah.

536. "Weights and dimensions of Cast Iron Pipe and Fittings." A handy reference book for Municipalities and Contractors, 48 pages 7 1/4 x 10 3/4. R. D. Wood & Co., Philadelphia.

539. "Handbook of Cast Iron Pipe" contains useful tables and data for the Water Works man on pipe line construction, weights and dimensions. U. S. Cast Iron Pipe and Foundry Company, Burlington, N. J.

Pipe Line Construction

550. Pipe Lines and the Caterpillar. In this 32-page booklet are pictured many uses of the Caterpillar Tractor, and ways in which they can be applied to the saving of men, money and minutes. The Caterpillar Tractor Co., Peoria, Ill.

Pumps, Centrifugal

560. Centrifugal pumps for high or low service pumping for waterworks and filtration plants. Bulletins contain installation photos, characteristic curves, and valuable design data. Dayton-Dowd Co. Mfrs. Centrifugal Pumps, Quincy, Ill.

561. Centrifugal Pump data—Double suction centrifugal pumps are described in Bulletin 197; multi-stage centrifugals in Bulletin 200; deep well turbines in Bulletin 211, and a number of municipal pump installations in Bulletin 178. The American Well Works, Aurora, Ill.

Pumping Engines

575. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Screens

576. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

Storage

579. "Modern Water Storage" is the title of a new booklet just issued by the Pittsburgh-Des Moines Steel Co., 3454 Neville Island, Pittsburgh, Pa. It contains 23 pages of reliable information, interesting photographs, authentic engineering data and "Pittsburgh-Des Moines" specifications on various types of elevated tanks, penstocks, pipe lines, stand pipes, steel reservoirs, treating plants and complete water systems. Copies free on request.

Tank and Stand Pipe Data

582. A 50-page booklet issued by Pittsburgh-Des Moines Steel Co., 3479 Neville Island, Pittsburgh, Pa., on complete water works plants, elevated tanks, stand pipes and filtration plants. Much valuable data in handy form for the water works engineer.

Tapping and Valve Machines

583. Descriptive matter dealing with many labor saving devices such as the Smith tapping machine valve inserting machine and pipe cutting machines. The A. P. Smith Company of East Orange, N. J.

584. A new booklet just issued by Mueller Company, Decatur, Ill., fully describes and illustrates the new line of Mueller Tapping Sleeves, Valves and Drilling Machines for water works officials.

Valves

585. Bronze and Iron Valves for service on Steam, Water, Gas, Gasoline, Air and Oil lines. Data book furnished upon request. Also data on "Dart" Unions and Fittings. The Fairbanks Company, 393 Lafayette Street, New York, N. Y.

Miscellaneous

Airport Construction

595. Airports and Airways. A 20-page illustrated booklet by the Caterpillar Tractor Co., Peoria, Ill., describes the uses of tractors in building airports and handling planes.

597. "Getting on the Air Map With 'Caterpillar,'" profusely illustrated with action pictures, describes the many uses of the tractor in building and maintaining airports better, quicker, cheaper. Caterpillar Tractor Co., San Leandro, Calif., and Peoria, Ill.

Airport Drainage

599. The Toncan Culvert Handbook, containing 56 pages of typical Toncan Culvert installations and much valuable data pertaining to the use of Toncan Perforated Iron Drains and Culverts for economical and permanent drainage of landing fields, will be sent free upon request. Address Toncan Culvert Mfrs. Assn., Massillon, Ohio.

Chains and Speed Reducers

607. Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill., gives full description of its positive drives in books No. 125. Silent Chain; No. 1257. Roller Chain; No. 815. Herringbone Speed Reducers; No. 1050. Promal Chains. Send for these positive power transmission books.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 566 Peoples Gas Bldg., Chicago, Ill.

Rules

625. The Lufkin Rule Company, Saginaw, Mich.; New York: Windsor, Canada. Manufacturers of Measuring Tapes, Boxwood Rules, Spring Joint Rules, Straight and Folding Steel Rules, Fine Mechanics Tools and Aluminum Folding Rules, General Catalog No. 11.

Transits and Levels

629. Berger engineering and surveying instruments are described in Catalog B, 140 pages. Other publications sent on request include Test and Adjustment of U. S. Coast & Geodetic Survey precise level, and Berger Focusing Systems. C. L. Berger & Sons, Inc., 37 Williams St., Boston, Mass.

630. Transits and Levels particularly adapted for City, County and State work are fully described and illustrated in a new 64-page catalog just published by the Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

PUBLIC WORKS

An Engineering and Construction Journal

City

County

State

VOL. 62

DECEMBER, 1931

NO. 12

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On the Other Foot:

It seems as though many of our readers don't have enough to do, or else they like mental gymnastics as a rest cure. Anyway they are strong on this problem business. We have been handing out problems to them long enough; now we are going to put the shoe on the other foot, and we hereby announce a contest, with prizes, for the best problem. The rules are:

Send in your problem before January 1, 1932. Problems must be accompanied by a solution in a sealed envelope. The editors will judge which is best. Problems should be fairly original, or at least not commonly known. In other words, don't take them direct from "Mathematical Pastimes" or any similar source. They should be hard enough to be interesting (but not too awful hard). Prizes will be given as follows:

First prize \$5.00
Second prize 2-year subscription
3rd, 4th, and 5th Prizes 1-year subscriptions
(All others used will be paid for by 1-year subscriptions).

Mikey & Ikey:

Just about everyone in possession of a slide rule (and probably some that weren't) worked on what Amiel Reichstein calls "Mikey and Ikey." The editor was about snowed under with returns, the number received preventing individual acknowledgements. Due to this large number of replies, it has been decided to give five (instead of three) one-year subscriptions. The winners were, in the order named:

George S. Bloomgren, Chief Assistant Engineer, East Liverpool, Ohio.

C. P. Lewellen, care Howard R. Green Co., Consulting Engineers, Cedar Rapids, Ia.

Amiel Reichstein, City Engineer and Supt. of Water Works, Fairfield, Iowa.

J. K. Hoskins, U. S. Public Health Service, Cincinnati, Ohio.

F. H. Horner, 200 West Thornton St., Akron, Ohio.

Joseph J. Gilbert, North Hills, Pa.

It takes a hard heart to turn down all the other correct answers, and we hate to do it. In addition, there were a number of incorrect replies, but we won't tell on them.

Below we give Mr. Hoskins' solution as being about the simplest and clearest:

Let x equal Ike's age

and y equal Mike's age

then x plus y equal 100 (1)

x plus y is expression when Mike was 10 years older than Ike is now.

$y - (x \text{ plus } 10)$ is expression for difference in ages at that time.

$x - [y - (x \text{ plus } 10)]$ is Ike's age when Mike was 10 years older than Ike is now.

But—

$x - [y - (x \text{ plus } 10)]$ equals $y/1.25$ (2)

(Solution Continued on page 70)

J. T. MORRIS
President

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PUBLIC WORKS

Founded in 1896

A. PRESCOTT FOLWELL, Editor

Published Monthly

at 310 East 45th St., New York, N. Y.

Western Office: 122 South Michigan Ave., Chicago

SUMNER N. HUME
New York, N. Y.

JOSEPH E. O'CONNOR
Chicago, Ill.

SUBSCRIPTION RATES: United States and Possessions, Mexico and Cuba.....\$3.00

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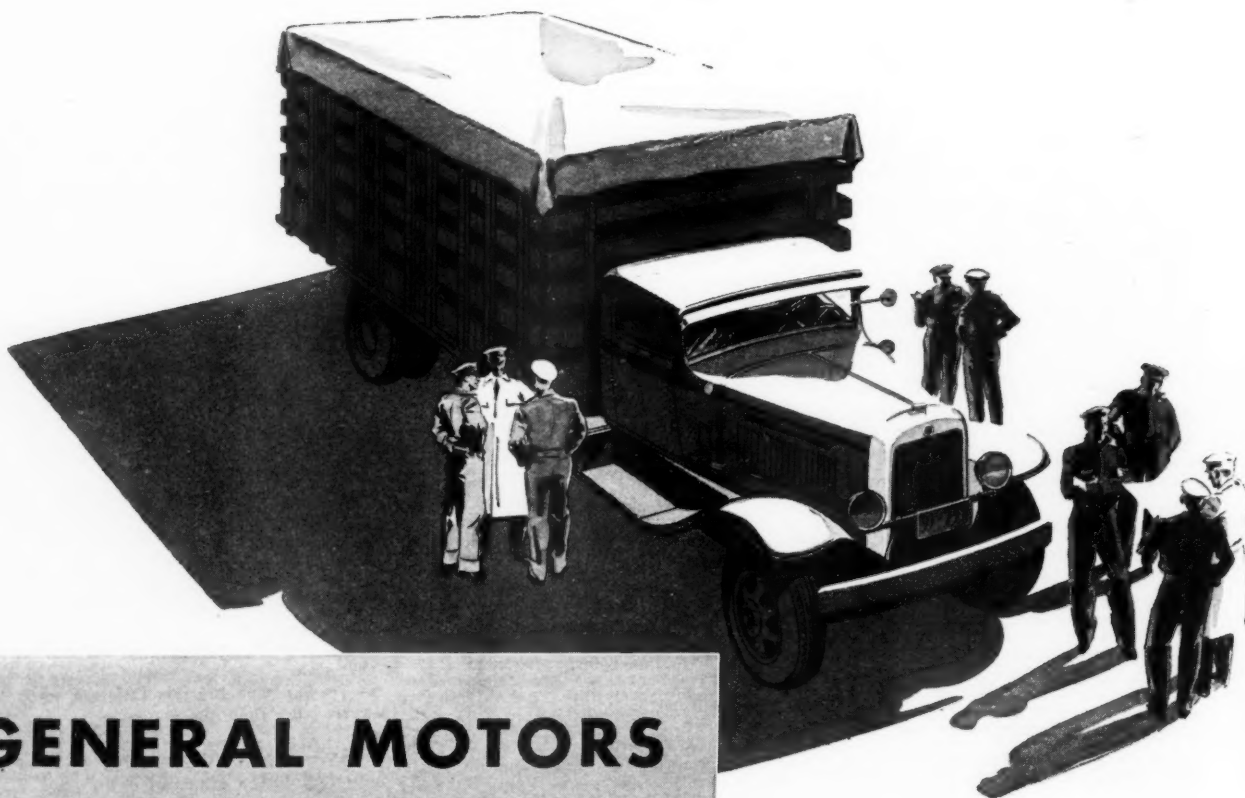
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PUBLIC WORKS

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AN ENGINEERING AND CONSTRUCTION MONTHLY

Vol. 62

December, 1931

No. 12

How New Bedford Solves Its Garbage Problem

Outlined by Superintendent Austin M. Thresher to M. S. Sullivan

AFTER some thirty years of struggle and study with the problems, costs and methods of garbage and rubbish disposal, the City of New Bedford, Massachusetts, now has an incinerating plant which it believes to be one of the most economical and efficient in the country. The outstanding facts are these: In nearly five years the plant has never broken down; the cost of plant upkeep has been but \$1,938; the cost of actual incineration is \$1.517 per ton; only 87 tons of coal were consumed in 1930 for incinerating 19,809 tons of mixed garbage and refuse.

The city's experience in this matter goes back to 1900, when garbage was disposed of by means of a reduction plant which was then privately owned.*

In 1921, the city purchased the reduction plant, with which it acquired about 48 acres of land in the northwestern section of the city. This plant was destroyed in 1923, and was replaced with a more modern make of reduction plant. The city, however, was not satisfied with this plant and sought a system that would be more economical, efficient and sanitary, as well as one that would last over a period of many years.

In 1925 the city engaged Samuel A. Greeley of the engineering firm, Pearse, Greeley and Hansen of Chicago, to conduct a survey of the city and to recommend the garbage disposal system best suited to its particular needs. Upon Mr. Greeley's recommendations, the Board of Health advertised for bids for a 100-ton incinerator. Eight bids were received. The

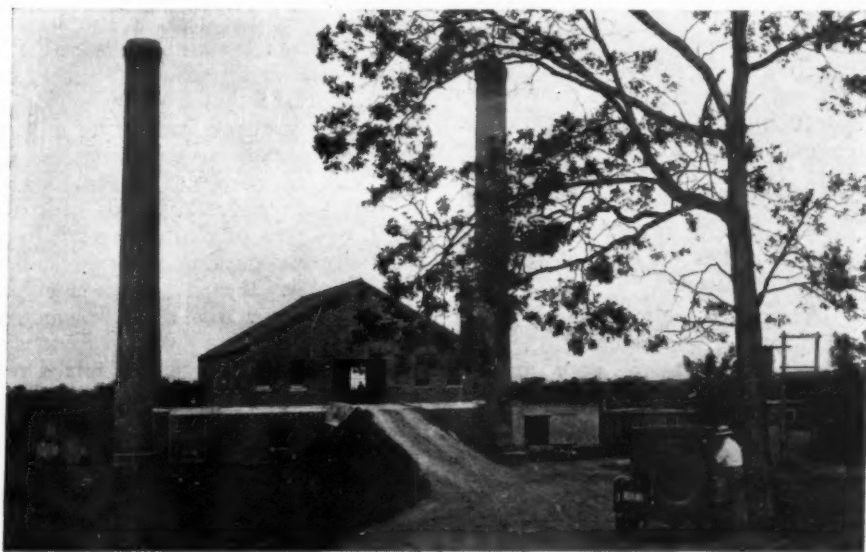
Board of Health then commissioned Mr. Greeley and Austin M. Thresher, superintendent of the reduction plant, to inspect at least one operating incinerator of each of the firms from whom bids were received. Both agreed to recommend acceptance of the bid of the Superior Incinerator Company of Dallas, Texas, which plant was purchased at a price of \$99,500. This figure included everything with the exception of a small amount of rock excavating in the construction work, the entire cost coming inside of \$100,000. The services of the engineer, travelling expenses of mem-

bers who inspected various plants, the drawing and making of the specifications, advertising and all other expenses incidental to the purchase came to \$7,000. New Bedford is proud of the fact that her incinerator was purchased entirely on merit with not one bit of graft. To this fact the city fathers point with pride as

one of the factors that gave them an efficient plant.

The plant was constructed on the land occupied by the reduction plant, being 48 acres of fields and sparse woodlands located about 2½ miles out of the city centre, in a section where there are but few dwellings. The plant has a rated capacity of burning in 24 hours 100 tons of a mixture of 72 per cent garbage and 28 per cent rubbish.

The plant was designed for the city's population of 112,000, but can take care of the refuse from a much larger population. New Bedford is largely a textile centre, and wastes from the mills are brought to the incinerator by trucks owned by these various companies.



Building of New Bedford incinerator.

*This plant and service, for which the city paid \$25,500 a year, was described in "Municipal Journal and Engineer" (the former name of PUBLIC WORKS) for February 26, 1908.

The incinerator was placed in operation in January, 1927. Since then the largest amount of garbage and rubbish handled in any one day has been 127 tons; in one period of eight hours, 100 tons was burned.

The plant consists of a two-story brick building, 55 feet wide and 77 feet long, in which there are four furnaces, one located in each quarter of the building. Each is equipped with three sets of grates with an area of 165 square feet, and each has three feed scuttles located on the second floor. On each side of the building is a 100-foot stack, one for each two furnaces.

The furnaces are constructed with 12-inch brick walls and insulation which keeps the outside of the furnaces fairly cool in spite of high temperatures inside. Working conditions here are much better than in some incinerator plants, especially in the summer, when the temperature is only slightly higher than that of the outdoors, Mr. Thresher reporting temperatures about two degrees higher even on some of the summer's hottest days, although the furnaces were fired at high temperatures for disposing of heavy tonnage.

Collections are made with fourteen Ford trucks with 3-yard bodies, and two Ford trucks with 8-yard bodies. The former carry the ordinary household collections, bringing in mixed loads, while the latter work largely through commercial sections, collecting meats and other wastes from stores, combustible materials and such. One truck daily goes to hotels and restaurants, and trucks for rubbish go three times a week to stores. Collection is done under contract, so that the city does not own the trucks, but their working schedule and operation come under the supervision of the incinerator management, so that the city has control over this work. In spite of the fact that these trucks are over two years old, they are still in A-1 condition. Each driver is held responsible for the looks of his truck, which makes the fleet of trucks a source of pride when in the streets.

Incoming trucks drive up an incline leading to the second floor of the building. Upon entering, they are driven over a scale platform where each load is weighed by the foreman, and the weight recorded. The trucks then proceed to dump their loads into one of four furnaces as they are directed by the foreman. All trucks are equipped with dump bodies so that material goes directly into the furnace scuttle. For

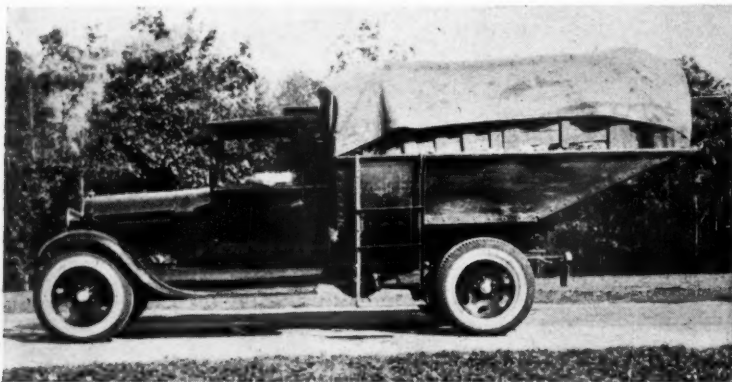
each furnace, there are three scuttles, each three feet in diameter. For the two furnaces on each side there is provided a movable $\frac{1}{2}$ -ton electric hoist which lifts and replaces the heavy iron covers over the scuttles.

As the load is dumped into the scuttle, two or three stokers on the floor below shake and turn the fires to hasten incineration and to help ashes fall through the grates to the ash pits. Two men work about $2\frac{1}{2}$ hours each morning, removing ashes and dumping them outside the building on low lands which are being raised. Mr. Thresher reports about ten per cent ash from the mixed refuse.

Coming to plant operation, we find that it has not once broken down since it was placed in operation nearly five years ago and not a pound of garbage has been diverted through any other channel for emergency disposal. In nearly five years of operation, the cost of plant upkeep has been \$1,938. The cost for actual incineration ending November 30, 1930, for the year was \$1.517 per ton of mixed garbage and refuse. During that year 19,809 tons, composed of 38.2 per cent rubbish and 61.8 per cent garbage, were incinerated at a cost of \$30,053.26 made up of the following expenditures: Administration and labor \$26,216.60; other personnel, \$3,419.86; replacing drying pans, \$8.44; furnace castings, \$32. Including the entire outlay and compensation the cost of incinerating the 19,809 tons of refuse was \$37,637.10, or \$1.90 per ton. These figures include all costs of administration, which in some cities are divided between the cost of collection and disposal, or added to other activities.

Mr. Thresher has tried incinerating garbage alone, as well as garbage and refuse mixed, and finds that costs are greatly reduced when using mixed refuse. In 1928, incinerating 16,414 tons of garbage and rubbish separately, 739 tons of coal were used. In 1929, 614 tons of coal were used to incinerate 18,719 tons of refuse, garbage and rubbish being burned separately during the first seven months, while mixtures were incinerated the last five months, resulting in a saving of coal. In 1930, only 87 tons of coal were used to dispose of 19,809 tons of mixed refuse. At present an average of 0.32 ton of coal is used daily. Rubbish and garbage are mixed to some extent when loading, and again when dumped into the charging hole of the incinerator furnace.

(Continued on page 38)



New Bedford truck with canvas-covered load of mixed refuse.



Dumping at incinerator. Electric hoist is shown on track above truck.

Experimental Farm Roads in New York State

Nine roads constructed, each a mile long, and all with different types of construction, for comparing costs and qualities

CHAPTER 480 of the Laws of 1930 of New York State set aside not to exceed \$100,000 of the maintenance appropriation fund for building experimental third class roads, that is, roads of a type capable of carrying economically the traffic furnished by the average farming section. The district engineer of each of the districts one to nine (all the State except Long Island) was instructed to select a road in his district which would be fairly representative of its farm roads. For each of these a type of construction was worked out dependent upon the character of the traffic and the local materials available, and a mile of road (in District 3, 1.26 miles) was constructed.

All pavements were built 12 feet wide, with shoulders varying from 3 to 7 feet in width depending upon local topography. The costs include all necessary grading, but grading was kept at a minimum because it is not believed that a radical change of alignment and grades will be necessary in the construction of this type of road. Probably more pains were taken to secure excellent work than the ordinary town superintendent would have taken, and for that reason the costs are probably higher than they would have been if the work had been done under the supervision of a competent town superintendent.

The cost of the rental of equipment, exclusive of operators and supplies, has been purposely separated from the total cost, because in the case of towns having their own equipment the actual cash outlay for the construction of these various types of road will be considerably less than the total cost shown, although as a matter of good business a proper depreciation charge must be included. The average cost of rental of equipment on the 9 miles was \$1,939.73 per mile, which is a considerable proportion of the total cost.

No definite conclusions have been reached yet relative to types, except that, in general, local materials must be used if the cost is to be kept down to a figure which will permit any great amount of construction on the large mileage of this class of road in the State. In general, gravel should be used as a foundation course if it is locally available, and in many localities gravel will be sufficient for the top course either with or without a binder of some sort, provided care is taken to grade properly the top course gravel. In other sections where the local farm traffic, particularly milk hauling, is heavy, some type of surface treatment or top course will be necessary. Enough different types were constructed and enough specifications developed so that almost any situation can be met and there are probably other types of cheap construction which have not been tried but which are available.

There are in New York State approximately 50,000 miles of road which are included in neither the State nor county systems. Several thousand miles of these roads should be abandoned or are so unimportant that their improvement will not be warranted. Probably not to exceed 30,000 miles should be improved, and of these 30,000 miles at least 5,000 will be in counties such as Westchester and Erie which are rapidly developing and which the local authorities are caring for with a superior type of pavement. This leaves approximately 25,000 miles to be improved with some cheap type of construction, and we believe that the average cost of these roads, including the necessary grading and depreciation or rental of equipment, should be little if any above \$5,000 per mile, or a total cost of \$125,000,000.

A means of financing State highway and county
(Continued on page 54)

Details of Roads Built in the Nine Districts

Dist. No.	FOUNDATION COURSE	TOP COURSE	COST PER MILE	
			TOTAL	EQUIPMENT
1	5" of run-of-bank gravel, surface treated with 1/2 gal. of light cold tar.	5" of gravel, 1" or less, with constant ratio between sand and stone. 500 lin. ft. treated with 1 3/4 gal. of asphalt cut-back mixed in place with power grader; balance usual gravel top.	\$5,523	\$2,096
2	6" of run-of-bank gravel, laid in 3" courses and compacted.	Selected gravel, 2" or less, thoroughly rolled and treated with asphaltic emulsion, covered with fine crushed stone and rolled.	5,744	1,231
3	4" of broken stone filled with crusher dust.	2" retread mixed with light cold and light hot tars.....	6,126	737
4	10" of run-of-bank gravel laid in two courses.	2 1/2" retread, using No. 2 washed screened gravel as aggregate.	7,741	2,458
5	10" of run-of-bank gravel.	One half, 1 1/2" of No. 2 screened gravel penetrated with 1 3/4 gal. of asphaltic emulsion; other half, 3/4" of No. 2 screened gravel penetrated with 1 1/4" gal. of asphaltic emulsion; both covered with pea gravel, 25 lb. per sq. yd.....	7,780	1,459
6	5" of simple gravel construction, local run-of-bank gravel.	5" of run-of-bank gravel, stone above 1" removed. No bituminous treatment.	3,640	2,188
7	4" of crushed stone.	3" of broken stone filled with crusher dust and small stone. Traffic bound—no bituminous or other binder.....	8,582	2,662
8	8" to 12" of field stone filled with local gravel.	Entire surface, ditch to ditch, covered with run-of-bank gravel averaging 4" deep, honed and rolled to true, smooth-riding surface.	8,412	616
9	Two 6" courses of gravel rolled to 4 1/2", giving 9" total; light surface treatment of cold tar.	2 1/2" consolidated course of run-of-bank gravel mixed with cold tar by a power grader, giving a mulch of run-of-bank gravel and cold tar.....	7,769	4,093

Waterworks Emergencies From the Health Standpoint

By Warren J. Scott,

Director, Bureau of Sanitary Engineering, Connecticut State Department of Health

THE waterworks superintendent sometimes cannot induce his company or his water board to take forward looking steps to increase his supply. If he is forced to operate on a slender margin of safety in this regard, he should lay his plans as to what could be done in the case of a shortage due to drought. It may be that he can plan for an emergency connection to some neighboring public water system of ample capacity. There may be some near-by recreational lake free from serious sewage pollution and subject only to contamination from bathers so that an emergency pumping station, a chlorination outfit, and a force main to the distribution system may do the trick temporarily. Sometimes a connection can be made with an industrial water supply suitably treated.

In Connecticut, we have had to make emergency use of various types of temporary water supplies. In each case, the State Department of Health has made a hurried survey of the proposed supply and with the cooperation of residents and local health and water officials, has cleaned up dangerous conditions on the immediate watershed. The Connecticut State Department of Health has two emergency chlorinators on hand which have been installed by the Department in several shortage emergencies.

We have also required the waterworks management making use of make-shift supplies of poor quality to notify consumers that water should be boiled for drinking purposes. Notification was made personally by a waterworks representative or by newspaper announcement or both, depending on the quality of the emergency supply. This is an added safeguard that is usually worth-while even though it may not relieve the waterworks of legal responsibility.

Another emergency that frequently arises is the break-down of equipment used for purification of water supplies. Duplicate chlorination apparatus should be provided in all cases, and incidentally, spare chlorinators should be started up occasionally or they may be found wanting when needed.

Filtration plants—especially those of the rapid sand type—may break down for one reason or another. Sufficient storage in the clear well will give some opportunity to make repairs. Spare units should be available, also. By-passes around filter plants are frequently installed for emergency but adequate chlorination should be provided for if such by-passes are pressed into service.

A peculiar case happened in one Connecticut city recently. The city was drawing water from two supplies—a chlorinated gravity supply and a pumped filtered supply. The first supply suddenly developed a very offensive taste because of algae, and the whole system was thrown over on to the pumped supply. Normally, this pumped supply was used only during the night. Two filter plant operators were available—one for each twelve hour shift. Then one operator developed appendicitis, leaving only one man familiar

with the filter plant operation. The unpalatable gravity supply had to be temporarily used but the city succeeded quickly in securing the loan of a trained filter plant operator from a manufacturer of filter plant equipment, which tided them through. They did have to withstand a deluge of complaints, however, until the change could be made.

In order to cut down on operating costs, designing engineers are laying out rapid sand filtration plants on small systems which call for little operating attention—perhaps an average of two hours a day or less. These plants are frequently placed in charge of one man and nobody else in town is familiar with the operation. This is a dangerous plan. The possibility of sickness of or accident to a filter plant operator must be planned for, since it is not always easy to break in a man on short notice. The same applies to the operator of a chlorination plant. Human reserves are just as necessary as mechanical ones.

While not so serious from the health standpoint as pollution dangers, suddenly occurring odor and taste troubles on public water supplies may set up such a deluge of complaints that the waterworks superintendent feels that not only an emergency but a catastrophe has taken place.

One of the most frequent troubles is with tastes and odors from algae or other plankton growths. Some superintendents have had a great deal of such experience, and by means of regular microscopical analyses and copper sulphate treatment, they pretty well anticipate any difficulties. It is a strange thing that some reservoirs will go along for years without giving any algae trouble and then will suddenly break out. About two years ago I had occasion to confer with a superintendent on a small water supply system in the eastern part of the state and asked him whether they had ever had algae troubles. He had never heard of such difficulty. About two weeks later, he telephoned that the people were up in arms about the fishy taste of the water. We found a prolific growth of algae, but the trouble soon responded to copper sulphate treatment. The supply is now regularly treated.

From another Connecticut town we received one day a number of complaints about the chlorine taste of the water. We made residual chlorine tests and taste observations and were at first of the opinion that a temporary overdose of chlorine might have taken place. We made our inspection when the pump was in operation. The same night we received more complaints. We considered the possibility of adverse watershed conditions and cross connections. Finally we visited the two standpipes, one of which was a new standpipe and the other was an old one which had been painted during the preceding fall. Sampling the two standpipes and we found that the water in the old standpipe had a pronounced tarry taste. When the pump was stopped and the standpipe started to empty, the complaints began. This standpipe was

shut off and the trouble disappeared at once. The paint had been applied to an old uneven surface and had begun to peel off, exposing a soft undercoating which gave a decided taste when placed in water. Whether this sudden trouble was due to increased brittleness of the outside coating at low temperature or because of some other reason was uncertain.

The Commissioner of Health reported a complaint from a town about twenty miles from Hartford that the water tasted like carbolic acid. We found that a standpipe had received a hot tar application the day before and the taste had been imparted to the water. It soon disappeared.

On one large chlorinated surface water supply about two years ago, a highly disagreeable taste and odor condition developed and severe criticism resulted. We found that the taste was also present in the untreated water. It was in the early winter. A contractor for the highway department had just finished a new macadam road near the reservoir. The tar coating had been applied just as freezing weather came on so that the material did not penetrate. Then came a thaw and a heavy rain which washed down into the reservoir, causing a decided phenol taste and odor, which no doubt the chlorine accentuated.

Another emergency sometimes confronting the waterworks superintendent is an outbreak of sickness in his community and the rumor that the public water supply is infected. The superintendent who has an unfiltered and unchlorinated surface water supply is sometimes up against it hard in such a case, because samples sent in from his untreated supply may show bacterial organisms of the coli-aerogenes type, which casts suspicion on the water supply even though it is not responsible. Where a supply is treated by filtra-

tion or chlorination, the superintendent should have available a continuous record of residual chlorine and other tests so as to convince the health authorities of the safety of the water supply in the event of disease outbreaks.

We had one strange coincidence about five years ago in a Connecticut town where a new surface water supply with rapid sand filters and chlorination was turned into the system just previous to a typhoid outbreak. The system also secured water from an untreated surface supply. The president of the water company asked us if we recommended shutting off the new supply, which rumor held responsible, but we advised shutting off the old supply, which did not show up well bacteriologically although the watershed was clean. Very soon afterward, chlorination was installed on this old supply. The typhoid was later traced to a carrier in a food store but the epidemic caused the waterworks people a lot of worry.

In some sections of the country, extraordinary floods have created serious waterworks emergencies although this has not been a serious source of trouble in my own state to date.

The waterworks superintendent is frequently face to face with some new emergency problem but this is one of the things that make his job interesting and important. Extraordinary emergencies in the order of natural catastrophes can hardly be provided for in advance but a little private speculation from time to time by the individual superintendent on the emergencies that might reasonably occur is a good deal safer than to sit back and wait for them to descend unexpectedly.

The above information is from a paper presented before the New England Water Works Association at the Boston, Mass., meeting.

Construction Work on the Hoover Dam

So far practically all the work on the Hoover dam has been devoted to grading approaches and building four 50-foot diversion tunnels, with a combined length of about 16,000 feet, to carry the flow of the Colorado around the dam during construction except during heavy floods.

The illustration shows the canyon at the site of the dam, the front of which will rise just beyond the foot bridge across the river, which

shows rather faintly in the picture. At the right of the right end of the bridge is seen an auxiliary tunnel used in the construction of a diversion tunnel. For the photograph we are indebted to the International Harvester Co., fifty of whose trucks were ordered for this job by the Six Companies, Inc., the organization (a combination of six leading western contractors) which has the contract for building the dam.



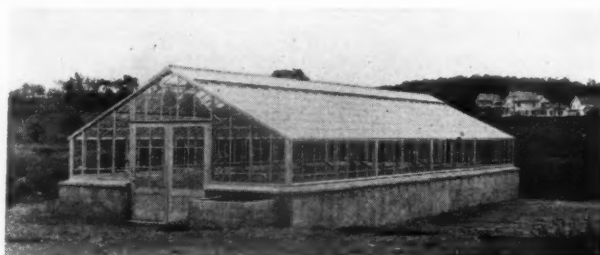
Extensions to the Newton, New Jersey, Sewage Treatment Works

By Thomas F. Bowe
Consulting Engineer, New York City.

NEWTON the county seat of Sussex county, New Jersey, is located on the watershed of Paulins Kill. The town, with a 1930 census of 5,401, has developed in a compact manner and requires only 10 to 12 miles of laterals and trunks to collect its sewage. The original treatment works were instituted in 1905 and consisted of flat-bottom septic tanks followed by sand filtration. No alterations or additions were made in the subsequent twenty-five year period until the recent extensions.

Sparta Street Plant

In view of the topography of the municipality the works were located at two sites, Sparta street and Clinton street. The former unit still affords adequate capacity to treat the prevailing flows, as the zone contributing sewage to it has not increased materially in population since its construction. The recent improvements at this site include a grit and screen chamber, improved baffling for the settling tank, a flow recording device and a new glass-covered sludge bed. The grit and screen chamber is constructed in two compartments, which permits grit removal, and is equipped with coarse screens with bars spaced two inches in the clear, which are to be manually raked. With these alterations and additions it is believed that this smaller plant will serve for a future period of ten years. Structurally this plant is intact, but the design is obsolete. However, in view of satisfactory results being obtained, further expenditure was not warranted at present.



Glass-covered sludge bed, Sparta street plant.

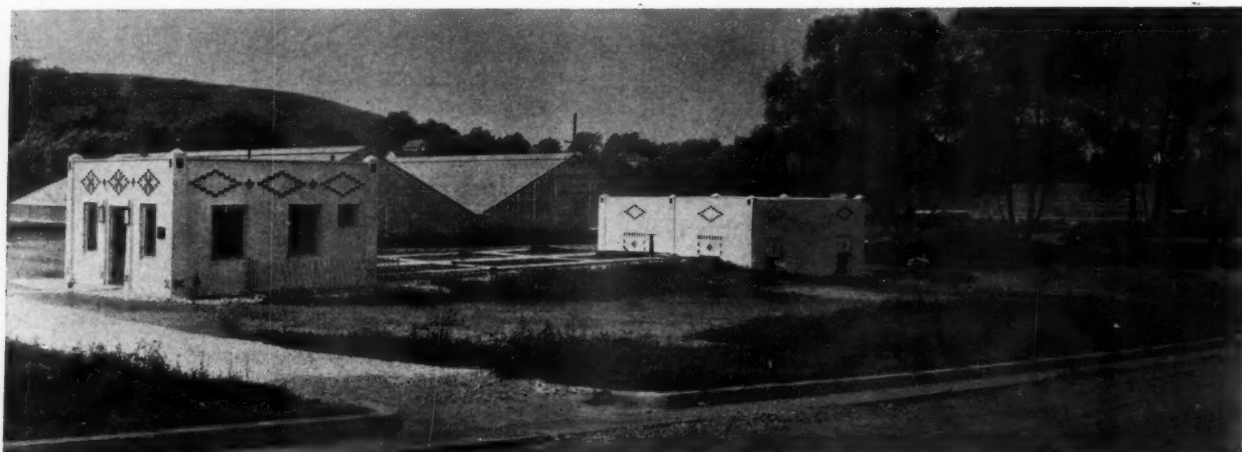
Clinton Street Plant

The Clinton street plant receives the flow from the business center as well as from the more densely developed residential section which have increased most in population since the initial construction. The volume of sewage entering the plant greatly exceeded its capacity, resulting in insufficient retention in the tanks and consequent flooding of sand beds with a poorly settled effluent.

The odors arising from these ponded filters were particularly objectionable because houses had been constructed on three boundaries and a municipal play-ground located on the fourth, and this and the increasing labor costs of maintenance warranted expenditure for increasing the capacity of the plant.

Improvements and Additions—In addition to improving and amplifying settling facilities, furnishing adequate secondary treatment presented a special problem. Additional sand filters were considered, but the ground available for this purpose is so low and swampy that the construction of them would have been too expensive, and the maintenance cost would have been increased. It was therefore decided to adopt an intermediate stage of clarification to permit a higher rate of application upon the existing sand beds and thereby expand their capacity without increasing their area. Local conditions influenced the adoption of a trickling filter with secondary settling for the intermediate stage of clarification.

The units recently installed comprise a new pri-



View of Clinton street plant. Primary settling tank and dosing tank in foreground. Glass-covered trickling filter directly behind them. Glass-covered sludge bed at extreme right.



Sewage treatment plant, at center and left center of picture, is surrounded by residences.

mary settling tank equipped for mechanical collection of sludge; trickling filter with dosing and final settling tank, also equipped for collection of sludge; glass-covered sludge bed; and modifications to convert the existing settling tank into a sludge digestion tank. Grit and screenings removal equipment, sewage and sludge pumps, switchboards and venturi meter were provided, all of which are housed in a control building.

Grit and Screen Chamber—The raw sewage is directed through a combination grit and screen chamber, wherein a single motor-driven device rakes the paper and rags from the screen bars and excavates the settled grit. The grit sump is triangular on the longitudinal section and with vertical sides. The bottom and surface velocities may be varied by an adjustable baffle and the volume of retained and removed material be so controlled. The screen bar spacing is one inch, which is considered the minimum for use in this type of plant.

The grit and screen mechanism is located within the controller house and is entirely encased within a steel plate covering. The material removed drops through a chute to a concrete chamber adjacent to the building, which may be operated as a compost tank or for temporary storage of screenings in cans or containers. At present, the machine is operated at frequent intervals and the accumulation removed and buried twice a week.

This combination unit appears particularly adaptable to small plants where the installation of individual grit removal and screen mechanisms are not warranted. Observations at many plants where manual operation is required indicate that grit and screen chambers do not receive proper attention. Even a conscientious operator finds it difficult to obtain the results for which these units are designed. Material caught by the bar screens is washed through by the weight of impounded sewage, and grit sumps rapidly fill without adequate means for proper cleaning.

Material removed by the mechanical grit and screen mechanism includes coffee grounds, pieces of soap, egg shells, newspapers, rags, etc., in greater quantities than had been anticipated in the design. The prompt removal of this material has reduced the amount of

scum and aided substantially in obtaining a clear effluent from the settling tank.

Settling Tank—The new settling tank is constructed in two compartments, each equipped with wooden paddles arranged to draw the settled material to hoppers constructed at the influent end of the tank, and, on their return along the upper surface, push the floating scum to the effluent end, where it is raked into a metal trough and thence drained to the sludge line. Vertical sludge withdrawal pipes extend from the bottom of the hoppers to a capped opening at the ground surface, with side outlets $4\frac{1}{2}$ feet below the flow line of the tank. A motor-driven bronze plunger pump with ball valves is provided for raising the sludge from the hoppers and scum from the troughs and delivering them to the digestion tank. Operation of mud valves permits settled sewage to enter the trough at one end, thereby flushing the accumulated matter to the opposite end and thence to the sludge intake line.

Trickling Filter—The availability of a suitable grade of quartz rock at an economical cost from a local quarry was a factor in the adoption of the trickling filter. Other considerations were the uniform, dependable and automatic operation which may be

expected from such a unit with a minimum of technical supervision. The filter consists of two concrete basins, each 47x106 feet in plan, filled with stone to a depth of 7 ft. 6 in., placed upon an underdrainage system of vitrified channel and grill blocks. The distribution lines are of 6 in. Universal joint cast-iron

pipe, laid near the surface, into which brass spray nozzles are threaded. The effluent flows in the collecting channels to a central concrete channel within each compartment. Drainage from the filter is controlled by sluice gates, which afford means of flooding the stone.

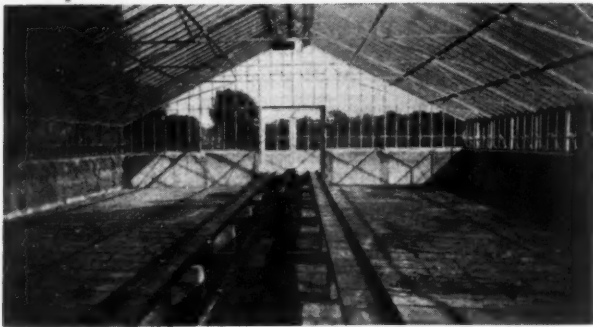
The filter area is covered with a glass superstructure to control possible odors emanating from the sprays and to maintain higher temperatures in the winter time. Recent tests have indicated that the efficiency of the filter parallels the temperature; that is, higher efficiency results with warmer filter temperature. (In this filter a heavy growth developed rapidly



Playground adjacent to Clinton street plant. Buildings of plant are seen in background.



Interior of trickling filter building, showing sprays in operation.



Interior of Clinton Street sludge bed.

and after four weeks of operation a stability of from 8-12 days was indicated by the methylene blue test.)

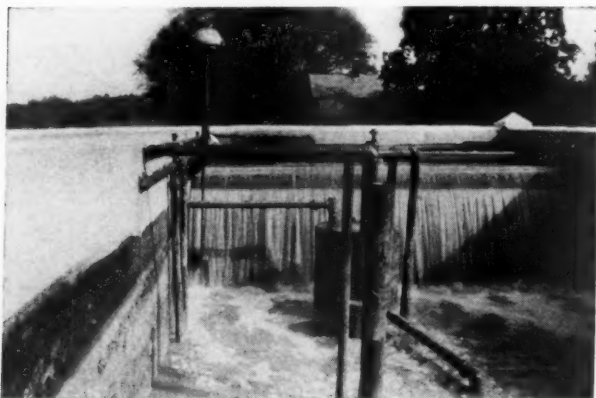
Other advantages of a glass covering are protection of filter medium from frost action and hence longer life; and improvement in the appearance of the filter.

Triple-Deck Unit—The dosing tank must be elevated in order to discharge its contents to the trickling filter, and the final tank located on ground of lower elevation to save excavation. In addition, a structure would be necessary to house the chlorination and pumping equipment, switchboard, etc. At this plant all these features are economically combined in a triple-deck unit, the final tank providing the foundation for the elevated dosing tank and the space between utilized for pump, chlorinators and tool rooms. Numerous windows which have been provided afford an unusually bright and pleasant interior.

Dosing Tanks—The dosing tanks are of the twin type, which permits equal volumes of settled sewage being applied on the filters at each dose. Two siphons, each 14" diameter, serve identical compartments, which alternately fill and discharge through a common feeder to all distribution lines and nozzles. The operation is automatic, the admission of liquid to each compartment being controlled by the discharge of liquid from the other. The bottoms of the dosing tanks are shaped so as to reduce the volume applied as the diameter of the spray circle decreases.

Final Settling Tank—The effluent from the trickling filter passes to the final settling tank, where an hour's detention is afforded. This unit also is constructed in two compartments and equipped for mechanical collection of settled solids, which are pumped from here to the digestion tank.

The resettled liquid spills over a weir into a storage well, from which it may be pumped to the sand filter



Dosing tank, Clinton street plant, while filling.

dosing tank, where it is applied in rotation by the original plural alternating siphons to the five sand beds. The effluent from this tank is of such clarity that rates of 300,000 gallons per day readily pass through the sand. The beds will serve for daily volumes of this amount when the capacity of the plant is reached.

By-Passes—The storage well at the final tank is so arranged that in case of emergency or when repairs or replacements are required in connection with the sand filters, the flow will automatically pass through the main outfall line, by-passing the sand filters. At such times, the effluent is discharged with a residual chlorine content.

At the effluent end of the primary settling tanks, overflow weirs are provided and so designed that a maximum rate of flow may be set for the trickling filter and the balance directed to the sand filter. This arrangement automatically directs the settled sewage to the sand, by-passing the trickling filters, in case of discontinuance of power or pumping. With these arrangements, the two types of filters can be operated in parallel as well as in series, with any prearranged portion of the total flow treated on the respective filters.

Sewage Pumps—The sewage pumps are of the Wood trash design, of the vertical type with motor above floor and pump in a dry well or pit. Pumps are installed in duplicate, are float switch controlled and may be actuated by either float. Each pump has a capacity of 1160 gallons per minute or more than three times the average daily flow. A new feature of design is the deep well type pump shaft support; a large-diameter cast-iron casing holds the pump, shaft and motor in alignment and supports the shaft bearings. The design is neater than the channel bracing commonly employed.

Flow Measurement—A venturi tube with registering, indicating, recording meter, installed within the controller house, measures the flow of settled sewage from the primary settling tank. Flow through the tanks has a tendency to even out the peak rates before measurement, but the dependability at this point is greater than if measurement of the raw sewage was attempted. Counters of the compression type are placed on the dosing tanks of both sand and trickling filter and afford an accurate volumetric measurement, as each dose is of a known amount. Records of the total flow and of the proportion treated on each type of filter are thus available.

Chlorination—Two vacuum solution feed chlorinators are installed, one for pre-chlorination and the other for final chlorination. These are located within the dosing tank building in a separate room of ample size to store a large number of chlorine tanks. A dormant type scale is provided for weighing the chlorine available in tanks connected with the machines.

The solution for pre-chlorination is discharged through rubber hosing encased in a vitrified pipe conduit and is applied in the grit chamber, one hundred feet from the machine. That applied to the final effluent is introduced in a manhole ahead of the final settling tanks. Proper distribution of the chlorine solution in the liquid is obtained by a diffuser consisting of a perforated hard rubber pipe eighteen

(Continued on page 60)

Organization of the Division of Sewers and Paving, St. Louis

IN 1914 St. Louis adopted a new charter by which all members of the Board of Public Service are appointive officers. These are:

The President of the board, who is really the city engineer, under whose charge all new construction is carried out.

The Director of Streets and Sewers, in charge of the maintenance of streets and sewers, to whom all new dedications of public highways by private parties are referred and under whose supervision all legal steps are instituted towards the opening or widening of new streets or public highways.

The Director of Public Utilities has charge of the municipal power plants, the municipal lighting system, the municipal water works, and his department supervises the construction by private utilities of underground or overhead structures.

The Director of Public Welfare supervises the Park Department, the Health Department and the hospitals and other similar institutions maintained by the city.

The Director of Public Safety, whose department consists of the Fire Department, Building Commissioner and Inspector of Weights and Measures.

The Department of the President of the Board of Public Service is further divided into:

1. The President's Office.
2. The Secretary's Office.
3. The Division of Sewers and Paving.
4. The Division of Bridges and Buildings.
5. The Division of Special Taxes.

The Division of Sewers and Paving is purely a design and supervising engineering organization. By it plans are prepared, bids are received and contracts let on all public work involving new street and sewer construction, and the work carried out by the contractors as the result of these contracts is supervised. In carrying out this work, the policy of the Board of Public Service has been to let all new construction work by contract, the city not maintaining any labor organization to compete against contractors for this work.

Under the direction of the chief engineer (which position has been held for fourteen years by W. W. Horner) and his assistant, the work of the division is carried out by the following sections:

One—A Clerical Section, headed by a chief clerk, under whom all the clerical and stenographic work is performed, such as preparation of hearings, and of

The constitution of the American Society of Municipal Engineers provides for local sections, and the first of these to be formed was the Saint Louis Section. This section is very active, and holds meetings at least once a month. One of the features of these meetings is an address by a city official describing some feature of the municipal public works. All citizens are invited to listen to these talks, the invitations carrying the standard explanations "Mr. Tax Payer, meet Mr. Municipal Engineer, under whose supervision your tax money is spent." On April 21st the president of the section, H. Shifrin, assistant chief engineer, Division of Sewers and Paving, described "The Form of Organization of the Division of Sewers and Paving, Department of the President, Board of Public Service, City of St. Louis." He described quite fully not only the organization but also the duties and functions of this division and the charter regulations which determine them. In this article we have abstracted that part of his address describing the organization, which should be of interest to members of similar organizations in other cities.

Ordinances as the result of such hearings, writing of contract and specifications, and the general technical and routine correspondence which is usual for an engineering office.

Two—A Surveying Section, headed by an office engineer assisted by a field engineer in charge of parties. Each survey party consists of one surveyor, one instrumentman and two rodmen. This survey section is separate and distinct during the construction season from the survey parties assigned to the engineers in charge of paving and sewer construction.

For the last three or four years this section has had between seven and nine survey parties, which number is augmented during the weather when no paving is being carried out by the survey parties assigned to paving construction. All land surveying, leveling and surveys necessary for establishment of sewer districts for the improvement and reconstruction of streets and alleys, is carried out by this section.

Three—A "Drafting Section," headed by the chief draftsman, prepares the plats by plotting up all of the survey notes made by the survey section in the form of record profiles, record plats, preliminary and final opening plats for condemnation, improvement plans for street improvement, etc.

In recent years, this section has consisted of a chief draftsman and approximately twenty draftsmen of various grades ranging from those usually known as "tracers" to professional draftsmen familiar with plotting all forms of land surveying notes. (As a rule all drafting required in the preparation of the construction plans for sewer work has been carried out by the engineers and draftsmen of the Sewer Design Section.)

Four—Sewer Design Section. This section consists of a principal assistant engineer in charge of sewer design and four to six engineers of the various grades, one or two draftsmen and two gauge readers (who gather the records of the automatic rain gauges used in storm sewer designing).

In recent years, the bulk of the work of the Sewer Design and Construction Sections has consisted of design and construction of relief sewer systems made necessary by the inadequate sewers originally constructed.

Five—Sewer Construction Section. The engineer in

(Continued on page 69)

Sewer Construction Through Embankment and Soft Ground

By Walter S. Wheeler
City Engineer, Dover, New Hampshire

Jacking corrugated pipe through railroad and other embankments has become standard practice under certain conditions, and is usually performed without much difficulty. The following article describes a job which was an exception, and how it was completed successfully in spite of the unusual difficulties.

DURING the summer and fall of the year 1927 the city of Dover, New Hampshire, constructed a 30-inch reinforced concrete pipe sewer for storm and sanitary purposes that emptied into Berry brook at a point directly in front of the entrance to a stone culvert that carried Berry brook under an embankment on a branch line of the Boston and Maine Railroad.

After passing through the culvert, the brook continued several hundred feet before entering the Cocheco river. Many times the brook overflowed low ground between the embankment and the river, forming an open-air "settling basin" that covered nearly an acre of ground. This spot became very foul during hot weather, and the owners of the adjacent land threatened the city with a lawsuit unless the menace was removed, which, of course, the city was duty-bound to do.

After some study, it was found that the stone culvert was barely large enough to take care of the water during heavy storms, and for that reason it was finally decided to continue the 30-inch sewer under the embankment in a new location and beyond it to

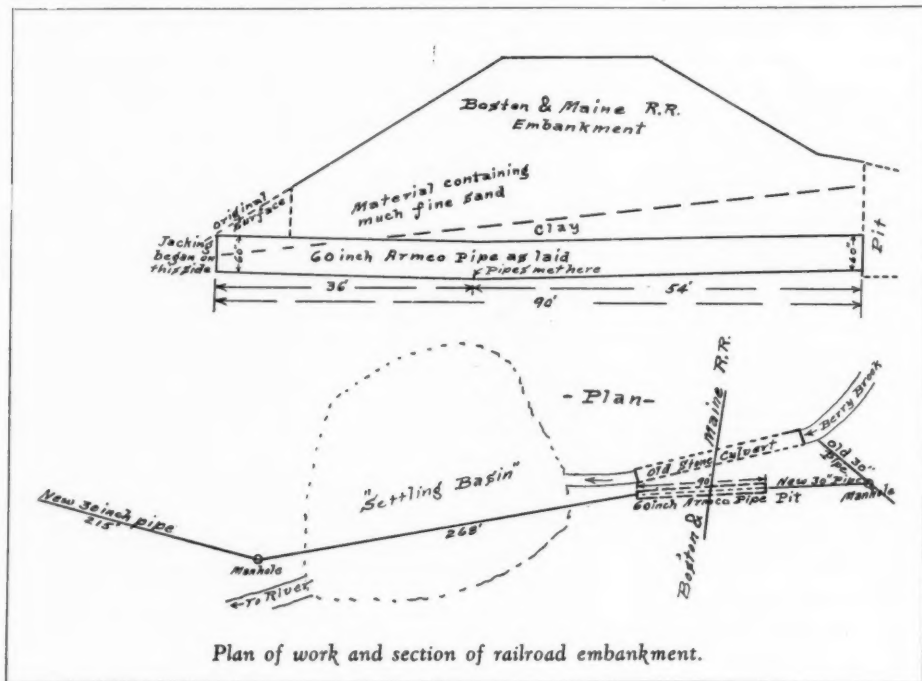
the river. In order to avoid, as far as possible, the stench, and the danger of the caving in of the banks through the "settling basin" during the construction, the sewer between the embankment and the river, through the "settling basin," was laid during January and February, 1930, when everything was frozen up.

The work was carried through successfully at less cost than would have been necessary in the summer, and gave employment to the men when they needed it most. The men seemed to like it, and they kept moving continually to keep warm.

It has long been our policy to construct sewers through soft, wet ground in the winter when the ground is frozen. Getting through the top frozen crust is more expensive in winter, but that is more than offset by the cheaper shoring and unwatering than would have to be done if the construction was carried on in the summer.

To facilitate the laying of the 30-inch sewer pipe through the railroad embankment, it was decided to jack a 60-inch conduit in place, and then lay the sewer pipe inside, backfilling afterwards between the 30-inch and the 60-inch pipe. Because of its strength, durability and adaptability to jacking, it was decided to use 60-inch 8-gauge Armco corrugated pipe in 10 and 12-foot sections.

From September 5 to 11 five men and a foreman worked ten hours daily hauling timbers with a truck and moving the pipe and timbers by hand about 1,000 feet through a swamp. The approach trench was dug in water and soft sticky clay, and it was necessary to keep a hand pump going while placing uprights for the backstop. Through the cooperation of the New England Metal Culvert Company, we obtained the services of one of their expert engineers, and the actual jacking was started.



The pipe was of necessity started in a location where the material was hard yellow clay around the bottom half of the pipe, but around the upper half and above it was mostly fine, dry sand. Two 50-ton jacks, placed in a horizontal position, were used to move the pipe forward. The pipe was in position and barely started in the bank on the 11th.

For a few feet everything seemed to work all right, but the jacking became more difficult as the pipe went in, and it was difficult to keep the pipe on grade on account of the friction caused by fine sand collecting in the corrugations on top of, and around the sides of the pipe. The bank on the approach end slid down after four hours' jacking, and obtaining and placing shoring caused about six hours loss of jacking time. The first section of 11 feet was in bank Saturday, 6:30 A. M., ready for the joint. The second section was put in position and the joint made, and we were ready to jack at 4:00 P. M.

Monday, the 15th, the second joint was made at 7:00 A. M. to 3 P. M. A few feet more and we found that in spite of everything we could do, the pipe was lowering in grade when it should have been rising. Little progress was made on Monday night. On the 15th and 16th we moved about two feet. A checkup showed that we had 36 feet of pipe connected up with about 26 feet of it in the embankment. The line was perfect but the forward end of the pipe in the embankment lowered four inches when it should have risen four inches in that distance.

The pipe was going very hard Tuesday, the 16th, with only about two feet of progress made all day. Wednesday, July 17, in the morning, there was only about two feet of excavation ahead of the pipe and no movement of the pipe all night. When we tried to move the pipe Wednesday morning the pipe would deflect but would not move in the bank.

In some soils the line and grade may vary a few inches and sometimes the pipe will become fast and it will be impossible to jack it farther. When the pipe does become fast, as it did in this case, three things that can be done, and the choice depends a great deal upon sound engineering judgment. They are as follows:

1. Excavate and shore a trench over the pipe and then either lift it out or continue jacking with the outside friction thus removed.
2. Thread another pipe of smaller diameter through the pipe that is fast.
3. Jack the rest of the pipe from the opposite side of the embankment on a predetermined line and grade to meet the pipe that has become fast.

The Armco engineer who had been on the job since the work started suggested that it might be well to thread a 54-inch through the 60-inch pipe that was fast. This would have been large enough for our purpose but when we conferred with the factory we found that it would take too long to manufacture the 54-inch pipe and get it on the job. It was then decided to jack the rest of the pipe in from the opposite side of the embankment. In order to do this it was necessary first to dig a pit on that side in virgin soil about 14 feet deep and large enough to admit a 12-foot section of the 60-inch corrugated pipe, and work the jacks. The material was found to be hard, yellow clay with very few wet seams, and the same material was later encountered the rest of the

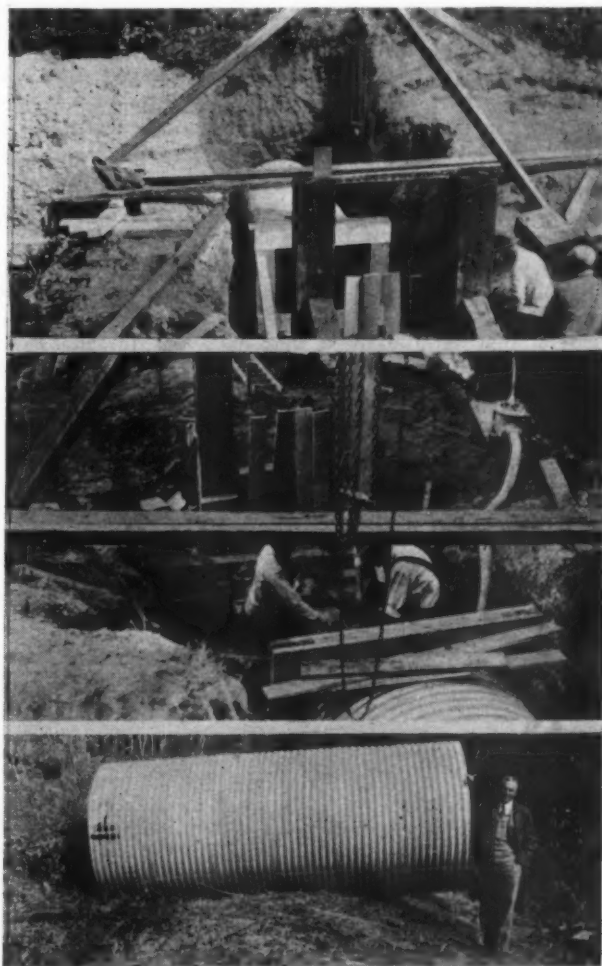
way back where we finally made the connection of the sections of pipe under the embankment.

We made little headway in excavating the pit in this material, and it was necessary to use an air compressor and pneumatic spade. It took five men and a foreman about two weeks, ten hours a day, to dig this pit and move equipment and pipe to the other side. The digging would have had to be done anyway and would not ordinarily be charged to jacking. Then the three days for moving equipment to the other side was repetition of work. The pipe was started Monday, October 6, and jacking continued with no further trouble until finished October 17. After jacking actually began from the opposite side, it took a crew of five men and a foreman 192 working hours to complete the jacking of the remaining 54 feet of 60-inch pipe back to meet the 56 feet that had become fast.

The pipe advanced between 3 and 4 feet per day of 12 working hours on this side. The 192 working hours mentioned above, 1,152 man-hours, included the time spent by these men in lowering the 60-inch pipe into the pit, bolting it together, jacking, excavating ahead of the pipe as it advanced and removing the excavated material from the pit.

A pneumatic spade was used on the clay, and the

(Continued on page 69)



TOP—Starting first length of pipe into embankment. MIDDLE Shows timber frame on pipe end, two jacks, and thrust blocks. BOTTOM—One of the pipes used.

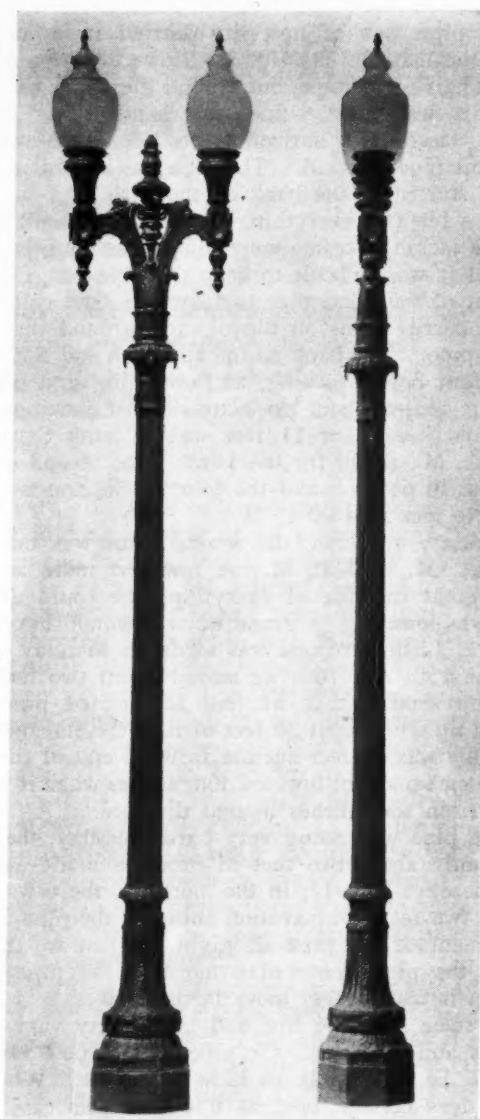
Street Lighting in Oakland's Central Business District

By C. W. Geiger

OAKLAND, Calif., has installed what it believes to be one of the finest high-intensity lighting systems in the country, with provision for future development along the lines of wise city planning. In preparing the specifications, careful consideration was given to cost of installation and operation, appearance of the standards and of the street by day as well as by night, and necessity for cleaning, painting and adjusting, as well as the illumination measured in terms of visibility, light distribution and absence of glare; preliminary to which, the experience of practically every large city in the country was studied.

The lighting system as a whole was designed and laid out by, and the plans and specifications were prepared by, the Electrical Department of the City of Oakland. The decorative features or details of the lighting standard were designed by Capt. J. W. Gosling, decorative designer in charge of the art studios of the General Electric Company, who incorporated several distinctive architectural features of Oakland's city hall in the design. Thus Oakland has a design of standard which is distinctly its own and is known as the Oakland design. The mechanical details were designed by the city's Electrical Department, and the modeling in clay of the decorative details, for use in making the patterns, was done under its supervision.

The luminaire used is that designed for the Fine Arts Commission of Washington, D. C., which will be used for all future ornamental street lighting in the District of Columbia. It was selected as that best adapted to Oakland's requirements from the standpoint of appearance, efficiency and light distribution, after samples submitted by different manufacturing concerns had been installed in Oakland for demonstration. In selecting both standard and luminaire, simplicity, architectural detail and dignity were given precedence to ornateness.



Oakland two-light standard.

The installation comprises 690 2-light standards, together with the underground conduit and cable for the series circuits interconnecting the standards.

The lighting standards are 20 feet high to the light center. They are of sectional cast iron construction internally reinforced with a vertical 4-inch extra-strong wrought steel pipe, the lower end of which is embedded in the concrete foundation on which the standard is supported. A considerable

(Continued on page 67)



Broadway and Twelfth.



Broadway and Telegraph.

Effect of the 1930-'31 Drought Upon Public Water Supplies

THE 1930 drought has dramatized, as never before, the need of safe, adequate, palatable, public water supplies.

With these words E. S. Tisdale, director, Division of Sanitary Engineering, West Virginia State Department of Health, began a paper before the American Public Health Association which many considered the outstanding one of the convention. In it he described briefly the experiences of each of the states most seriously affected by the drought, obtaining his facts from the sanitary engineers of the several states.

Space permits us to give only a summary of the more significant points of these descriptions, followed by the author's summing up and conclusions in full.

Six states—Pennsylvania, Maryland, West Virginia, Ohio, Virginia and Kentucky—lying for the most part on the watersheds of the Ohio and Potomac rivers, formed the heart of the drought area, with a combined area of 200,000 square miles. The deficiency of rainfall in these states would have covered this entire area two feet deep.

In addition to the deficiency of rainfall, an excessive evaporation rate was caused by the high summer temperature, resulting in unprecedented depletion of stored water supplies, and of shallow ground water supplies through capillary action and transpiration.

The percentages of normal rainfall for the year 1930 and for July and August of that year for each of the states was as follows:

	Penn.	Md.	W.Va.	O.	Va.	Ky.
Year 1930...	68%	56%	59%	71%	60%	61%
July & August	43%	31%	48%	53%	39%	45%

For ten adjacent states, which Mr. Tisdale calls the "fringe states," the percentages were as follows:

	N.Y.	Ill.	Mich.	Wis.	Ind.	Ia.	Mo.	Ok.	Tenn.	Ga.
Year 1930...	82	77	74	82	76	81	79	94	80	93
July & August	69	44	37	52	57	54	39	49	59	70

Pennsylvania: During the last six months of 1930, five completely equipped automobile laboratories, usually used for stream pollution investigations, examined 5,000 private and public water supplies to assist cities and rural communities in obtaining safe supplies. It was necessary for 125 cities and towns distributed over more than half the area of the state to use auxiliary or emergency water supplies, or both; but in spite of this, no increase in typhoid fever was noted.

In the western part of the state, which suffered most, acid mine drainage with little or no dilution was largely responsible. L. S. Morgan, district engineer of that area, cites the following seven effects of the highly acid, very hard water on filter plant operation:

1. Inadequate capacity of chemical feed equipment.
2. Production of abnormal quantities of sludge.
3. Inadequate sedimentation basin capacity.
4. Inadequate facilities for sludge removal.
5. Shortened filter runs.
6. Increased cost of treatment.
7. Failure to reduce hardness to satisfactory point to send into city mains.

At Apollo, the Kiskiminitas river, a highly acid

stream, had to be used and a hardness of 1900 p.p.m. was recorded. As the water plant was designed to handle only 300 p.p.m. hardness, the difficulties are obvious.

Several cities in western Pennsylvania found that, when the drought finally broke, the chlorine demand of the water exceeded the range of their disinfection equipment; and a mouldy, musty taste prevailed along the Ohio down to its mouth at Cairo, Ill., which nothing except, perhaps, the activated carbon treatment would counteract.

Maryland: Fifty-six thousand people living around Washington, D. C. are supplied by the Washington Suburban Sanitary District with filtered water from Anacostia river, stored in reservoirs. In July these reservoirs became practically empty and after that water was obtained from the District of Columbia water system. While the last dregs of water were being drained from the reservoirs, with considerable algae present and the river very low, many of the consumers suffered from a type of dysentery, which prevailed later in several cities using Ohio river water when that river flushed out in November and December.

Due to diminished flow of rivers, salty tidal waters set further up into streams in the tidewater districts of Maryland, Pennsylvania and Virginia. At Havre de Grace and Perry Point the stream salinity increased from 7 p.p.m. in May to 885 p.p.m. in December. Unusual fish mortality in streams emptying into Chesapeake Bay was believed to be due to the greatly increased salinity, since there were no unusual conditions of pollution, temperature or oxygen content. Similar fish mortality was observed in the Kanawha and Ohio rivers while water supplies drawn from them were occasioning intestinal disorders and may have been due, in these cases, to unusual chemical results of decomposition of organic matters in the water.

Ohio: Cities in the south-eastern section depending upon storage saw their reservoirs dry up entirely. State sanitary engineers took charge of the emergency relief work. Abandoned mines and drilled wells saved the day. At the time this paper was written 65 wells were being drilled at a cost of approximately \$150 each. The 1931 legislature authorized the expenditure of \$10,000 for such wells, the work to be done by the Sanitary Engineering Division of the State Health Department.

In late December and January, 1931, when the Ohio river began to flow, "a musty, rivery, nauseating taste persisted in both raw and purified water despite all efforts to remove it." Two cities discontinued chlorination and used excess lime and another used potassium permanganate successfully. Five cities used the ammonia chlorine process, but while it prevented phenolic tastes it did not overcome the stronger "rivery" taste. At least three cities removed this taste by means of activated carbon, using approximately 50 pounds of nuchar per million gallons at a cost of about \$4.00.

These tastes were accompanied by an outbreak of intestinal trouble similar to that experienced in Maryland. Bacteriologically these waters met the Treasury Department standard for a safe supply. As a result of these experiences, Ohio river cities are now installing or considering the installation of ammonia chlorine or activated carbon equipment to be able to cope with any type of tastes which appear, drought or no drought.

Kentucky: At the peak of the drought, one-third of Kentucky's public water supplies were forced to adopt emergency measures. The storage reservoirs in the limestone "blue grass" area became bone dry and most cities lived on transported water. Shelbyville hauled Louisville water 30 miles in sixteen 10,000-gallon railroad tank cars daily for twenty-five weeks. Lexington built a 6½-mile emergency pipe line to the Kentucky river in record time.

At Louisville the Ohio river, although clear, had an algae and plankton content of many thousands per c.c. instead of the normal hundreds and was unpalatable despite every kind of treatment. In December it experienced the same intestinal disorders as described under Maryland and Ohio.

West Virginia: Tygart Valley river, 1,340 sq. mi. drainage area, fell to a flow of 1.5 sec. ft. The Elk river, 1,550 sq. mi. drainage area, dried up for all practical purposes, and the canalized Kanawha river, which it joins, backed up its channel, carrying gross sewage and garbage pollution to the intake of the Charleston water supply. The water, when filtered, gave satisfactory bacteriological analyses, but a nauseating taste and odor persisted all summer. In November more than 5,000 consumers suffered from temporary intestinal disorders characterized by a sudden onset, pain in the region of the stomach, usually nausea or vomiting or both, followed by diarrhea of varying severity. The State Health authorities, assisted in their investigations by R. E. Tarbett, sanitary engineer, and Dr. M. V. Veldee, epidemiologist of the U. S. Public Health Service, reached the following conclusions:

1. That too gross pollution existed at the regular water intake due to back flow from the sewage zone.
2. That the raw water in the stream had zero dissolved oxygen at times.
3. That the raw water count was excessive—200,000 per c.c.
4. That the B. Coli content of 10,000 per c.c. was too high for safety.
5. That the organic matter, algae and protozoa were extremely high, calling for a 21 lb. per million gal. chlorine dosage to supply the chlorine demand.

Similar intestinal disorders were experienced at Weston and Sistersville.

Virginia: Eighteen cities and towns had to adopt emergency measures, on which, among others, Newport News spent \$83,000, Front Royal \$19,000, Harrisonburg \$27,000, Bluefield \$40,000 and Staunton \$8,000. Chlorination of emergency supplies was one of the major measures taken. The marine base, Quantico, when its source of water dried up, brought filtered water from Norfolk and Indian Head by barges.

The Author's Summary

Intense Stream Pollution: One outstanding and persistent trouble in all drought affected states was the prodigious algae growth in streams and storage basins, with the accompanying organic load and the

resulting nauseating tastes and odors. In many cases all known means of relieving the condition were tried without success.

The series of 53 artificial lakes in the Ohio river extending from Pittsburgh, Pa., to Cairo, Ill., into which sewage and industrial wastes poured and from which there was almost no flow except by displacement by polluted water, constituted basins where pollution progressively increased throughout the summer months. It is no wonder that water drawn from these basins was difficult to treat to make potable even in modern water purification plants.

The "Great Drought" has warned the people of the Ohio drainage basin that pollution of their river has reached the limit and that the cooperative principle successfully carried out by the eleven states on the basin in eliminating *phenol*, a damaging trade waste, should be extended to other industrial and to sewage wastes.

The Interstate Conservation Agreement of 1924, used so successfully in eliminating phenol, should without delay be enlarged in scope to reduce stream pollution on this great waterway.

Taste and Odor Control: Research work has been stimulated along the line of taste and odor control and the principles being developed in the laboratory were given an extensive application over the eastern part of the United States. Oklahoma lists 12 cities which have adopted ammonia chlorine control of tastes and odors since January, 1931. Ohio, West Virginia and Pennsylvania now have many plants equipped with both ammonia chlorine and activated carbon treatment units, and it seems likely that these processes will soon be incorporated into routine plant operation nearly everywhere.

Intestinal Disorders Apparently Due to Heavy Organic Loads With Algae: The several instances over this drought area where definite intestinal disorders have appeared associated with bad tastes and heavy organic loads can not be overlooked. The fringe of towns and cities around Washington, D. C.; Charleston, Weston and Sistersville, W. Va.; Ashland and Louisville, Ky.; and Portsmouth, Ironton and Cincinnati, Ohio, all testify that something unusual in the way of intestinal disorders appeared during the drought, and it may be that algae in heavy concentrations, with the resulting heavy organic load, were a factor in bringing about these troubles.

It is significant that Charleston, W. Va., on the Kanawha river where the organic load on raw water was heaviest (as evidenced by a chlorine demand of approximately 20 pounds per million gallons), experienced the most severe type of intestinal disorders; while Ohio river cities, where there had not been the opportunity for such tremendous putrefaction of organic matter, were not as severely affected. At Charleston an unusually close check was maintained upon the bacteriological quality of the final effluent, so that a water meeting the Treasury Department standard for a bacteriologically safe water was delivered at all times.

R. F. Goudey, sanitary engineer, Department of Water and Power, Los Angeles, in discussing sewage reclamation in the Los Angeles Metropolitan area (Engineering News-Record, March 12th, 1931), men-

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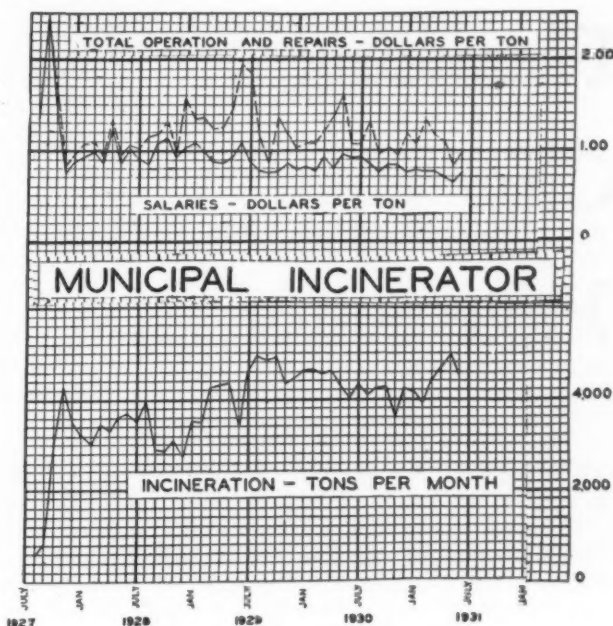
Refuse Disposal in Los Angeles

LOS ANGELES, Calif., is one of the few cities which keep careful and complete records of the various features of refuse collection and disposal, both amounts and costs. The daily records are totaled by months, and these monthly totals are plotted on a chart which has been kept for 16 years.

The refuse is collected separately as garbage; non-combustible domestic rubbish; and combustible rubbish and market refuse. Garbage and non-combustible domestic rubbish are collected by city employees with city-owned equipment. (The latter includes ashes, of which there is very little.) Combustible rubbish and market refuse are not collected by the city, but by licensed collectors who are paid directly by the producers.

For collecting the garbage the city uses 56 motor trucks and 56 mule-drawn wagons, both equipped with removable steel tanks holding 4.47 cu.-yds. level full and carrying an average net load of about 5,000 pounds, and a maximum exceeding 7,000 pounds. These tanks are hauled to a railroad siding and unloaded onto gondola cars, by which they are hauled to a hog farm by a private company, which pays the city for the garbage f. o. b. Los Angeles. The amount of garbage collected has increased from a minimum of 100 tons a day in 1914 to a maximum of 579 tons in July, 1931. July, the melon month, gives the maximum each year, and from November to May the quantity runs about 70 or 80% of the maximum. In 1929 and 1931 the garbage averaged 0.85 pound per person per day, and 0.81 pound in 1930. All garbage is weighed, as a basis of payment by the company.

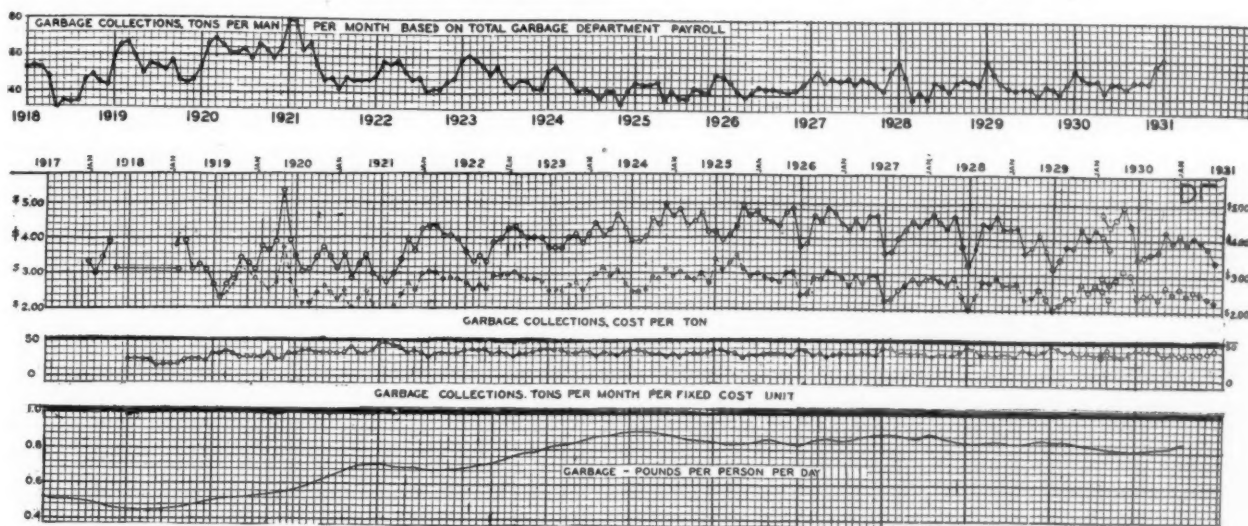
The mule-drawn wagons are operated by one man who both drives and collects the garbage. (The garbage pails must be placed at the curb by the house-



Operation of incinerator for past four years.

holders.) The motor trucks are operated by three men, one driving and the other two emptying the pails. From the records it has been calculated that it costs 2.87 times as much to operate a motor unit as a mule-drawn one (depreciation and interest included), while the former picks up garbage 1.75 times as fast and travels 2.75 times as fast as the latter at average speeds. Therefore, for ordinary routes within its cruising radius, the team unit is more economical than the motor. But on routes where grades are steep the motor trucks are preferable, and also for overtime emergency trips; and they can be detoured more readily out of the regular route to pick up isolated or missed collections. The average speed of the teams to and from work is 3.52 miles an hour, and that of the truck 9.64 miles an hour. The one-man horse-drawn truck averages 85 pick-ups an hour, and the three-man motor truck 148 pick-ups.

The amount of garbage collected during the past
(Continued on page 38)



Amounts and costs of garbage collection in Los Angeles for fourteen years past. Plotted from monthly totals of daily records kept by the department.

Financing City Pavements



A satisfactory low-cost pavement on a residential street. Bituminous gravel surfaced street in Elizabeth City, N. C.

By Harry Tucker

Professor of Highway Engineering, North Carolina State College of Agriculture and Engineering

CONTRACT prices for paving are extremely low now, and many cities would find it profitable to undertake paving programs at a time when most value can be had for a dollar expended. But it is hardly likely that many cities will find its property owners willing, during this depression, to assume the additional burden of paving assessments. However, a thorough study of the traffic on the different streets, a selection for each street of a type of pavement which will meet its requirements and at the same time be economical, and an equitable distribution of the cost between the city and the property owners, will enable the city authorities to prepare a paving program acceptable to a majority of the property owners.

This would involve more use than at present of the general fund of the city for financing paving of residential streets; and this, in turn, some additional form of revenue or else very great economies in the construction of the pavements.

In a city of 30,000 people, with 120 miles of paved streets, the annual cost of paving, reconstruction and maintenance of streets will be close to \$500,000, including interest, sinking fund requirements and maintenance charges. In few cases would all of this be included in the annual budget, for it is quite likely that most of the paving has been financed by the property owners through special assessments; but, whether included in the budget or not, the property owners of such a city would be burdened to the extent of about \$500,000 per year for paving alone.

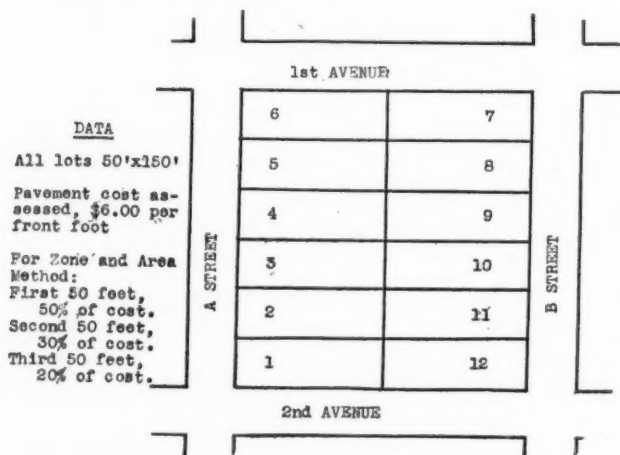


Fig. 1—Illustrating different methods of assessing the cost of paving.

Sources of Revenue

Motor License Fees and Gasoline Taxes.—The total taxes collected from motor vehicles in 1930 were as follows:

Motor vehicle registration fees.....	\$355,704,860
Gasoline tax	494,683,410
Personal property and municipal taxes	150,000,000

Total\$1,000,388,270

A comparison of the registration of motor vehicles in 187 representative cities with the total population of these same cities indicates that there is an average of one motor vehicle for every 4.2 inhabitants of the cities. Assuming that the ratio of urban to the total population is fifty-two per cent, this would mean that about 14,500,000 motor vehicles are owned by residents of cities. This is almost exactly sixty per cent of the total motor vehicles registered in the United States.

It may safely be assumed that the rural owners of motor vehicles drive them in cities at least to the extent that city owners drive on rural highways. It would seem, then, on this assumption, that the cities should receive about sixty per cent of the total receipts from motor vehicle fees and the gasoline tax. This would amount to about \$510,000,000. In 1930 the incorporated cities and towns in some of the States received a portion of the proceeds of the motor vehicle taxes, but the total amount of these taxes refunded by all the states to both cities and counties amounted to only

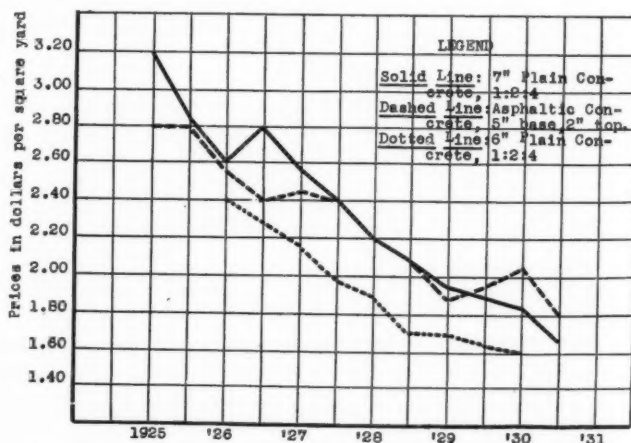


Fig. 2—Comparative costs of several types of pavement for the period 1925 to 1931.

\$165,000,000, which is about twenty per cent of the total collected from such taxes; and by far the larger share of this refund was received by the counties.

It is argued and may be granted that the development of many cities has been due largely to the construction of state highway systems. But many of the state highway systems as originally planned are about completed, and it would seem fair that from now on the cities should receive a share of the income from motor vehicles; especially as the states are receiving even larger appropriations of Federal aid, a share of which could thus be passed on indirectly to the cities.

Not only are the counties sharing in these traffic taxes directly, but many of the states are adding to their highway systems additional mileages of rural roads; both of which afford distinct relief to tax-distressed rural property. If such relief is proper for the counties, it would seem just as logical for the cities to receive a fair share of the highway taxes collected from motor vehicles.

Where the state highway systems are not yet completed, a certain measure of relief can still be afforded the smaller cities by having those streets over which highway traffic is directed incorporated into the state highway system for construction and maintenance.

Special Assessments.—It is generally the practice to require that owners of at least fifty-one per cent of the street frontage sign a petition for paving a street before this is ordered. Varying percentages of the cost of the paving are then assessed against the property; but it is becoming the custom in many of the smaller cities for the property to bear the entire cost. Paving under this plan is usually undertaken during periods of great real estate activity; and when a depression follows, there is always difficulty in meeting the assessments.

A difficulty in using special assessments is selection of a satisfactory method of assessing the cost against individual pieces of property. Where lots are of the same frontage and of equal depth, the front-foot method will work satisfactorily, except for the owner of a corner lot, the assessment against which may be so great that it exceeds the value of the property. Many engineers favor this plan because of its simplicity of application; but it is inequitable, and a better plan should be adopted. It would seem that a combination of the front-foot method and the area method, with a varying percentage of the cost to be assessed under each method, would probably prove satisfactory.

Figure 1 shows a rectangular city block divided into lots of equal size, with the cost of paving assessed against the abutting property. The example illustrates the wide variation in paving costs for different lots under the several methods of making the assessments, as well as the discrimination against corner lots which results from the use of the front foot method.

Cost of Paving for Typical Lots

Lot No.	Front Foot	Area	Zone and Area	25% Frontage 75% Area	50% Frontage 50% Area	75% Frontage 25% Area
1	\$1200	\$600	\$750	\$750	\$900	\$1050
2	300	600	570	525	450	375
3	300	600	480	525	450	375

The period over which paving assessments are spread is likewise an important consideration. It should be of such length, and in such relation to the

percentage of the cost borne by the property, that the owner would not be unduly burdened to meet the yearly charges. There would not seem to be any reason why these charges should not be spread over the life of the pavement. This, for any of the high-type pavements, would be about twenty years; yet it is a common practice to require the property owner to pay his portion of the cost of the pavement in not over ten equal yearly installments. If a longer period were used, there would be less objection to the yearly payments during the periods of real estate depression.

Important also is the interest rate charged the property owners on deferred payments. Two principles can be stated about this: 1—In general, the interest rate should not exceed that at which the city is borrowing money; and 2—the installments to be paid each year should include the annual interest on the deferred payments. The latter is not entirely in accordance with the usual custom, which is to add the accumulated interest from the time the pavement was completed to the annual payment when it falls due. It would be still better to work out the annual payments on an amortized basis, so that they will include both interest and principal, and all be equal in amount.

Postponing the collection of any interest on a given annual installment until such installment falls due might seem to favor the property owner. On the other hand, by this method, each successive payment becomes greater; but as these paving programs are usually undertaken when property owners feel that they can easily pay the small yearly assessments, the first installment should certainly be at least as large as subsequent yearly payments. Otherwise, when a period of paving activity is followed by one of real estate depression, the property owner's position is further complicated by constantly increasing paving assessments to be met each year. And this likewise retards the sale of property, since future assessments must be paid by the purchaser.

While the method of paving residential streets by special assessments is sound and practicable, it is evident that the application of the method to particular cities and certain streets calls for careful study. The many details should be so worked out that the interests of all the citizens, and not only of those subject to the assessments, will be considered. The ability of the property to stand the yearly assessments is of major importance and should be made the basis for determining the percentage of the cost to be assessed against the property, the period of repayment, and the interest rate, as well as the detailed method of assessing the cost, or, finally, whether the street should be paved at all. Property owners are anxious to have improvements and are likely to forget the painful detail of paying for them if the payments are postponed, and the city authorities should act in the capacity of financial adviser, to the end that the property will not be unduly burdened.

Type of Pavement

A pavement to be used on residential streets should be pleasing in appearance, easy to clean, fairly durable, and with a dustless, non-skid surface. There are several low-cost surfaces which meet these requirements, such as surface treatment with bituminous materials, bituminous surfacings, and bituminous macadam. Where carefully constructed on substantial

(Continued on page 54)

THE READERS PAGE

Handling Sewage Sludge Gas

In view of the tragic and costly explosion of digestion tanks at Woonsocket, R. I. on Oct. 2nd, (the second such occurrence in about a year) a word about the design and handling of sludge digestion tanks would seem to be in order.

Such accidents are avoidable when the principles of sludge gas production are understood.

Mixtures of gas and air are inflammable when the gas constitutes between 5% and nearly 50% of the mixture, or, in other words, in any mixture that is respirable. Therefore when we "ventilate" a tank in order to prevent asphyxiation, we automatically produce an explosive mixture unless the ventilation is carried to such an extent that the gas is actually all removed.

Further, it is necessary to provide continuous, forced ventilation if there is any sludge in the tank, as sludge generates gas continuously. As long as there is any sludge in the tank, what may be a harmless mixture at one moment may become dangerous the next. This is particularly true, since sewage gas diffuses sluggishly and the mixture may vary widely in different parts of a tank.

For the above reasons, tests of the gas in a tank are of little use in predicting safety. It is a simple matter to test for carbon dioxide, and we may assume that the methane content will be from 3 to 5 times the CO₂ content, therefore, even 1% of CO₂ would indicate danger, but its absence would not indicate safety.

In a recent case in New York State, when it became necessary to send men into a digestion tank to make changes to a revolving sludge stirring mechanism, those in charge felt perfectly safe after they had filled the tank with sewage to displace the gas. They were, in fact, safe only in case that the tank was actually filled to overflowing with the sewage, AND in case there was no sludge in the tank after the sewage had been withdrawn.

In the Woonsocket case we are told that the tank had been partly emptied and that the covers had been removed for ventilation, before sending men in to repair the stirring mechanism. The removal of the covers simply provided ideal conditions for producing an explosive mixture.

It is unnecessary to seek the source of the spark that starts combustion. There is abundant proof that combustion has started in a number of cases, and our safety lies in avoiding explosive mixtures.

In Southern New Jersey, about a year ago, a sludge digestion tank with concrete cover above the sludge line blew up, causing havoc with the adjacent sludge bed covers, but fortunately with no loss of life. This explosion was blamed, I believe, on the curiosity of a couple of visitors to the plant after hours.

The fundamental fault, however, lay in providing space for gas between the sludge surface and the concrete cover. Such conditions should not be tolerated. It is understood, also, that in this plant there was an overflow or vent pipe from the upper part of the digestion tank to a point inside the glass sludge-bed enclosure. Such arrangements would be exceedingly dangerous as offering opportunity for air-gas mixtures, and also for ignition of the mixture within the glass enclosure where one would little suspect danger.

In repairing leaks in gas holders, the experienced gas man does not attempt to ventilate the tank to remove the gas. On the other-hand, he raises the pressure within the holder, makes sure that only air-free gas is pumped in, and then repairs the leak by welding on the outside.

Applying this principle, we should attempt to collect sludge gas only under positive pressure.

Again, applying the lessons brought out in this memo., we should avoid sending men into tanks containing any sludge whenever possible. When it is imperative to send men into tanks containing even a small quantity of sludge, we should provide powerful and continuous forced ventilation with blowers of sufficient capacity to keep all the air moving freely. Note the word **CONTINUOUS**.

As a corollary of the facts here brought out, we should avoid designs which provide for gas space within the tank; avoid vents or overflows which may provide connection with

the atmosphere; and avoid unnecessary mechanism, such as stirring devices within the tank, which may at any time require mechanical attention.

JOHN R. DOWNES.

Liability of Surety Companies for Depreciation

We have read with considerable interest the article "What Equipment Is Covered by the Contractor's Bond?"

While we generally agree that the surety companies should not be held liable for the purchase price of the equipment that can be used on other projects, we would like an article elaborating on the liability of the surety. Is it not generally held by court that the surety companies are liable for the contribution that the equipment is governed of itself toward the completion of the particular project bonded? In other words, are not the surety companies liable for the depreciation that the equipment has suffered on such project?

Certainly, there has been some definite contribution insofar as the value of the equipment has depreciated. The party or the municipality protected by the bond is the beneficiary and as such has received some contribution on every item of equipment, in addition to the contribution that it has received from materials, repairs and labor. It is generally conceded that articles that are consumed in the completion of the project should be covered by bond. We contend that the same logic should apply on that contribution that has been made of equipment itself.

Insofar as there has not been a standard method of computing the depreciation of equipment on various types of work, it will naturally be left to court or jury to determine the amount of the liability on each particular case as they come up. We believe some study should be given to this by your periodical in order to clear up in the minds of all just what the general ruling is in the above.

Pioneer Gravel Equipment Mfg. Co.

The matter referred to in the above letter would seem to be one for investigation of records of court decisions rather than for study. We accordingly asked Mr. Simpson, the author of the article referred to, to investigate this point. He has done so and reports that he finds but two references to depreciation (in connection with liability of surety companies) in the decisions of the higher courts. These references are given below. He says: "There has been a great deal of litigation on the subject of repairs to equipment, but nothing, I think, in the earlier decisions to answer your correspondent's precise question."

Nebraska Culvert & Mfg. Co. vs. J. A. Freeman (1924)
197 Iowa, 700:

A road sub-contractor bought a grader and wagons and after working about two months, quit the job and disappeared without paying anything on the purchase price. The grader and wagons were used on this job only. They were sold under execution. The material man claimed the difference between the original cost and the price realized as representing the rental value and the depreciation in value of the equipment during the time it was used on the job.

The court held that there could not possibly be any rental value involved, because the equipment was not rented. The syllabus reads:

"A bond conditioned to perform a contract and to pay all persons having contracts with the principal contractor or sub-contractor for labor or materials, given under a contract guaranteeing the payment of all just claim for 'material, supplies, tools and labor' against the contractor or any sub-contractor, does not embrace a claim for the depreciation in value of machinery purchased by a sub-contractor and used solely on the work called for by the contract."

The court said (p. 731): "Doubtless there was depreciation in the value of the equipment, but such depreciation

(Continued on page 69)

THE EDITOR'S PAGE

Twenty-five Years of Garbage Disposal

Twenty-five years ago "Municipal Journal and Engineer" (the name under which this periodical was then published) began a series of articles on "The Disposal of Municipal Waste," by Wm. F. Morse (inventor of the original Morse-Boulger furnace), which ran for about two years and was the most complete discussion of American practice in waste collection and disposal which had appeared up to that time. A comparison of practice then and now will be interesting as giving some idea of the progress made in this branch of municipal housekeeping. Comparison will be made between his figures, averaged for cities of more than 28,000 population, and the figures collected by us last month, averaging cities of more than 15,000.

The percentages employing the different methods were as follows: Incineration—17% in 1906; 42% in 1931. Reduction—12% in 1906; 2% in 1931. Feeding to animals—25% in 1906; 49% in 1931. Dumping—47% in 1906; 8% in 1931.

This shows some progress, the most gratifying being in the greatly reduced percentage of dumping—from 47% to 8%. This is all the more satisfactory when we consider that the 1931 figures include cities as small as 15,000, while none smaller than 28,000 were included in the earlier ones.

This reduction is due partly to desire to avoid creating a nuisance; but perhaps even more to the fact that most of the close-in low lands have now been filled with rubbish.

The other method of disposal showing a loss is reduction. The chief cause of this was undoubtedly financial; the cost of the plant and process is so great and the returns from the products so small that in most, if not all, cases the net cost is greater than that of incineration; while the practical impossibility of operating the plants without nuisance, except at great cost, has been a contributing cause.

Of the changes from these methods, almost exactly the same percentage of cities have changed to incineration and to hog feeding, respectively.

There were then, and are now, two or three new methods being tried out by a few cities (such as the Beccari system); but aside from these, the general methods of disposal remain fundamentally the same. However, improvements have been made in each, and most cities now pay much more attention to avoidance of creating a nuisance. Higher temperatures are secured in incinerators, thus practically eliminating nuisances from chimney odors and smoke, and odors from storage of garbage can be avoided in modern incinerators. Even the odors from hog farms have been greatly reduced by careful methods, although it seems impossible to eliminate them entirely.

But considering the progress and changes in many other branches of public endeavor during the past twenty-five years, that in garbage disposal is nothing to brag about; and it is to be hoped that 1956 will see much greater improvement—there is room for it.

For Useful, Permanent and Needed Public Works

Just now hundreds of communities are in the anomalous situation of raising huge sums for the relief of the unemployed, and, for the most part, spending this money on work which is useless or at least not especially necessary, although they are in need of better roads, pure and adequate water supplies, and proper waste disposal facilities, but find themselves unable to obtain the money for these needed improvements.

The employment of these relief funds for useful, permanent and needed public construction would not solve wholly the problem of providing our communities with such needed facilities, but it would help. We would call attention to a letter, printed on page 69 of this issue, from a city engineer who has taken the lead in his community in outlining some of its needs, so that if his suggestions for spending relief money are followed the community will have something more than an easy conscience to show for it.

It is difficult to spend relief money properly without a plan. The trained technical official, by popping up at this moment with a well-formulated plan for improving the streets, constructing sewers or drains, or doing other needed work, is more than likely to get done some of the things he has been urging for years, but for which he has been unable to obtain appropriations, and to win the merited approval of the citizens for his wise advice.

That Relief Dollar and Health

A house-to-house canvass of four of the largest cities of Illinois revealed the fact that there were more than 3,000 privies in each. One city of about 39,000 population had 4,548 outside toilets not connected to sewers. That conditions like these exist in nearly all cities and villages is common knowledge among sanitary engineers. Quite exact data were obtained from more than 1,000 communities in a survey made by this magazine two or three years ago, corroborating fully the above statements.

In many cities where sewers are available, the matter of connecting to them is neglected. In others there are large portions of the population, especially those living in the outskirts, which the sewers have not been extended to serve. Constructing these needed sewer lines and installing the necessary connections to them would afford maximum value for unemployment relief money.

In commenting on this side of the problem, the "Illinois Health Messenger" urges also the use of relief money for purchasing material and paying wages for constructing sanitary privies for schools, churches and community centers, and for providing material for the same purpose on properties whose renters are out of work and the owners of which are willing to accept labor on improvements instead of rental money. It also urges drainage for mosquito control, and screening houses to make them fly and mosquito proof, as of great value in disease prevention.

Refuse Disposal Data

Information furnished us during the past month by the leading technical officials of a large number of important cities relative to refuse collection and disposal practices and costs.

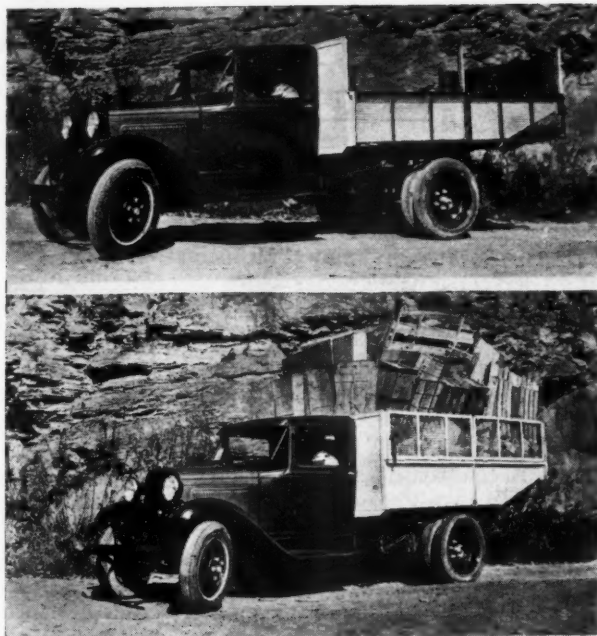
Amount of Garbage and Disposal Methods

The quantity of garbage collected is determined by weighing in 32 percent of the cities and measured in 5 percent. Thirty percent estimate the amount, most of them by counting the number of loads and estimating the average weight of a load. A number apparently make no effort to determine the quantity collected.

The amount collected per capita, as reported, varies widely; and in a number of cases garbage is mixed with more or less rubbish. Taking only those which collect garbage separately and weigh it, we find Los Angeles, Calif., reports 0.85 lb. per capita per day, or about 310 pounds a year; Pasadena, Calif., 365 pounds; Washington, D. C., 239 pounds; Dearborn, Mich., 164 pounds; Highland Park, Mich., 190 pounds; Royal Oak, Mich., 196 pounds; St. Louis, Mo., 160 pounds; Akron, O., 158; Cleveland, O., 261; University City, Mo., 329 pounds; Massillon, O., 106 pounds; Youngstown, O., 162 pounds; Norristown, Pa., 245 pounds; Madison, Wis., 265 pounds.

Figures were asked for each of the four last years, to learn if the financial depression has had any effect on the amount of garbage. While some showed from 1% to 10% decrease in 1930, others showed increases. As changes in population cause corresponding changes in amount of garbage, failure to estimate these correctly causes inaccuracy in the estimates of per capita quantities, and more definite information concerning the population figures used is necessary to give value to the figures reported. The figures given above, however, are for the year 1930, when the federal census was taken, and are presumably based on a reliable population figure.

There was no change last year in the methods of disposing of garbage employed by cities reporting to us, except that Paterson, N. J., dumped some instead of burning all in its incinerator as was done the year before; and Kenosha, Wis., dumps garbage which last year it fed to hogs. All or part of the garbage collected is incinerated in 42 percent of the cities, and all



Morgantown, W. Va., refuse truck. Above, sides down for loading. Below, rubbish piled on garbage, which fills bottom of truck.

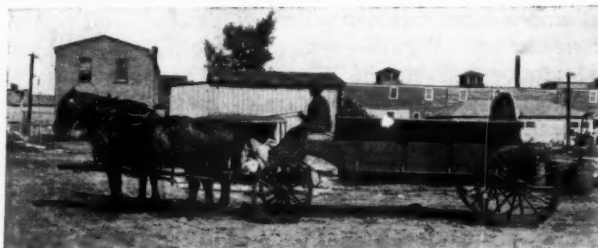
or part is fed to hogs in 49 percent. Five utilize the garbage by reduction. Only 8 percent dump all their garbage, but 23 percent dump part of it.

Refuse Collection Vehicles

When motor vehicles first came into use for refuse collection, it was quite generally considered that they were more suitable for large cities than for small. Since then, however, the smaller cities have adopted them more generally than the large. Of the cities reporting to us this year, 57 per cent are using no horse-drawn collection vehicles, only 5½ percent use all horse-drawn, and 37½ use some of each. Of the cities using no horse-drawn equipment, only 4 have a population of more than 75,000. Motor equipments constitute 87% of all collection vehicles in cities of less than 25,000 population; 74% of all vehicles in cities of 25,000 to 50,000; 45% in those of 50,000 to 75,000; and only 23½% in cities of more than 75,000. Moreover, only one of the cities reporting using no motor-vehicles had a population of less than 75,000.

Comparing total vehicles with total population of cities reporting, we find 62 motor vehicles and 125 horse-drawn vehicles for each million population. Taking the population of cities large enough for municipal collection of refuse as sixty million, the same ratio would give 3,720 motor vehicles and 7,500 horse-drawn used in refuse collection.

The capacities of motor trucks used varied from 1



Hartford, Conn., bottom-dump ash and rubbish wagon; 4 cu. yd. water level capacity.

to 9 tons. About 8% were 1-ton; 11% were 1½-ton; 8% were 2-ton; 7% were 2½-ton; 20% were 3-ton; 2% were 3½-ton; 20% were 5-ton; 8% were more than 5-ton; and the remaining 16% were of sizes not designated. The larger ones were not confined to the larger cities; 5-ton trucks were reported by four cities of less than 20,000 population.

Horse-drawn wagons varied in capacity from 1 to 13 cubic yards (most of the capacities of these were reported in cubic yards). Eleven percent were 2 cu. yd.; 9% were 3 cu. yd.; 4% were 4 cu. yd.; 10% were more than 4 cu. yd.; and the capacities of the others were not given.

The above figures are for refuse collection only, and do not include those used for removing street sweepings, catch-basin cleanings, etc.; although in a number of cities, especially the smaller ones, the same trucks are probably used for both.

Figures Concerning Refuse Incineration

Any one who endeavors to obtain and compare figures concerning the collection and incineration of municipal refuse appreciates the value of the service which the International Association of Public Works Officials is endeavoring to perform by the preparation and installing of standard forms for recording of such information. Only when standard forms are used will it be possible to obtain any definite ideas on this subject, to compare costs and results obtained, and to know what methods are most efficient.

An illustration of this is furnished by figures obtained last month by means of a questionnaire. For example, the cost of incinerating garbage and rubbish was reported as only 33 cents a ton by one city and over \$5 a ton by another; and collection as 90 cents in one city and \$4.73 in another. Conditions of course vary greatly in different cities, but we cannot believe that it really costs fifteen times as much in one city as in another to burn a ton of refuse. Taking garbage unmixed with rubbish, we still find the figures varying from 44 cents to over \$5.

The variation may be caused by errors in calculating cost of incineration or by errors in tonnage, or both. Probably the tonnage error is most common and excessive. One city reports 69 pounds of garbage per capita per year, another 1200 pounds. The average for cities of the United States is believed to be about 200 pounds, and it is improbable that in any city the actual garbage per capita is less than 125



5-ton Mack truck with special 16½-cu. yd. body. Used for ashes, rubbish and paper mixed in Newark, N. J.

pounds or more than 300 pounds. As one of our informants remarks, the only method of obtaining accurate figures is to weigh every load, but only twenty-five of our informants report doing so. Most of them "estimate" it, which is merely another name for "guess" in many cases, we believe. Quite a number weigh one or more loads assumed to be an average and keep a record of the number of loads.

Even with all garbage weighed, if the total is divided by an incorrect number as the assumed population of the city, or if garbage is not collected from all the population, the per capita quotient is incorrect.

For these reasons we are not giving the figures obtained. However, we have gone over them carefully and eliminated those which seemed probably incorrect, and averaged the remainder. This gives us the following results for collecting and incinerating refuse:

Cost of incineration, per ton—Average, \$1.52; maximum, \$2.46; minimum, \$0.84.

Cost of incineration, per capita—Average, 25.4 cents; maximum, 49.9 cents; minimum, 14.5 cents.

Cost of collecting, per ton—Average, \$3.11; maximum, \$4.73; minimum, \$1.79.

Cost of collecting, per capita—Average, 78 cents; maximum, \$1.40; minimum, 39 cents.

Twelve cities burning mixed refuse in incinerators report using no fuel, but most of them use more or less coal, cordwood, oil, shavings, coke or gas. All of those burning garbage alone must of course use some fuel.

Upkeep and repairs on an incinerator vary considerably from year to year, sometimes becoming quite large for the year when more or less reconstruction is necessary. Of the twenty-four cities reporting this item and the amount of refuse burned in 1930, we find costs varying from 2½ cents to \$6 a ton, the latter being for extensive repairs on an old incinerator. Omitting the latter, we find a maximum of 36 cents a ton, and an average of 12 cents a ton. Thirteen of them were below ten cents, five above twenty cents, and four between ten and twenty.



Type of sanitary refuse collection vehicle used by New Bedford, Mass.



University City, Mo., 3-ton rubbish truck is operated by the Health Department.

Using Unemployed Men on Street Cleaning

A Resumé of Experiences in a Number of Important Cities

ASKED whether they were using more men than formerly on street cleaning in order to relieve unemployment, and the quality of work obtained from them, city officials have given us all kinds of replies. Mark B. Owen, Superintendent of Public Works of Dearborn, Mich., reports "Idea excellent—quality good." John J. Shortell, street commissioner of Paterson, N. J., finds such men "Very helpful—good class of labor." Charles H. Lord, city engineer of Ogdensburg, N. Y., says "This is a very desirable way to relieve unemployment. Quality of work done by such employees is satisfactory." Edward Edgerley, city engineer of Lancaster, Pa., wrote: "We have found the extra men to be as efficient as the regulars and intend to increase the number when leaves begin to fall." But on the other hand, Allen L. Fox, city engineer of Blue Island, Ill., believes the efficiency is questionable and notes "a tendency to make the job last as long as possible." Wm. B. Schoenrogg, chief clerk, Indianapolis, says: "Inexperienced as such men naturally are, productivity and quality are far below standard." Geo. H. Sfeidel, city engineer of Pottsville, Pa., says that "most of the men do not show a disposition to give a fair day's work." Abe Pitzele says: "The quality of work is very poor and unsatisfactory."

Of 27 cities reporting the use of extra men for such work, 7 use them for full time, 20 for part time. The number employed, expressed as percentage of the number regularly employed on this class of work, varies from 10 percent (reported by eight cities) to 250 percent. Two report 25 percent, one 33 percent, three 50 percent, four 100 percent, one 175 percent and one 250 percent. Cicero doubled the number of men, and put all of them, old and new, on half time, each shift working two weeks at a time; but this does not furnish enough pay for any of them and the quality of work obtained is poor. Several expected to add a considerable number of men for sweeping leaves from the streets, and later for removing snow.

The various ideas on this subject entertained by different officials and some of the plans followed are represented by the following comments: "It is my experience, in putting on street cleaning work men who are not accustomed to doing this type of work, that they may be classed as only fair on the job; probably because they resent working in the districts in which they live." J. C. Albers, city engineer of Glendale, Calif. "A male stenographer cannot produce with pick and shovel." De Witt Dudley, city engineer, Santa Ana, Calif. In Chicago a relief committee will furnish men to the city free of charge and about 1000 will probably be used for street cleaning and snow removal. Several cities would be glad to use additional men on street cleaning, but have no funds for paying them, especially those which operate on a budget. The Chicago plan would apparently solve such cases.

From Waukegan, Ill., city engineer H. B. Bleck says: "If it is a question of work or doles, then this method of employment is very good. We have recommended hand street sweeping the entire paved street system of the city (75 miles) as one form of public

works upon which to expend the unemployment relief funds, raised by popular subscription."

A. G. Larsen, city auditor of Council Bluffs, thinks it is unfair to the driving public and dangerous to the men to use inexperienced men (and most of them are old also) for "white wings" work, where they are apt to be injured or killed by traffic. Leonard A. Bergman, director of public works of Jamestown, N. Y., also considers this "dangerous work for most of the unemployed men who would do this class of work."

In New Orleans relief employment is furnished in cutting grass, ditching and repairing unpaved streets, which is preferred to street cleaning, and is accomplished not less efficiently than with the regular force. There is more of such work to be done than men can be obtained for with the relief funds available.

Leominster, Mass., could use perhaps 50 men clearing away brush on the back roads.

P. T. Naylor, city engineer of Hastings, Neb., believes in using the extra men on permanent work rather than sweeping, which can be done so much more cheaply by machine. He has increased the street force by 50 percent and uses the extra men for filling cracks in pavements, raising sunken curbs and gutters, building sidewalks and setting curbs back on a 15-foot radius.

North Tonawanda, N. Y., does no hand cleaning of streets; uses extra men on ditch digging and cleaning, repairing streets, laying water mains, trimming trees, grading, etc.

Youngstown, O., employs extra men at 50 cts. an hour one day each week for work on streets and public parks—average 350 to 400 men a day.

"Work accomplishing more permanent results seems to satisfy public subscription to unemployment", says John L. McCutcheon, superintendent of sanitary department, Bradford, Pa.

Monessen, Pa., employs extra men in the outlying districts, where unpaved streets require drainage.

B. B. Weber, city Engineer of Oil City, Pa., believes that "there are various public improvements on which men can be used to greater benefit than on additional street cleaning," since their streets are already kept reasonably clean.

P. J. Hurtgen, director of public works of Kenosha, Wis., does not approve of hand cleaning streets, which costs more than machine cleaning.

E. E. Parker, city engineer of Madison, Wis., has "found that the work given to the 90 additional men of 3 days each per week has given us much cleaner streets and solved the unemployment problem for 90 very needy families."

Refuse Collection at Sioux City, Ia.

W. H. Carrigg, superintendent of the Department of Sanitation of Sioux City, Ia., says that that city is "the only city in the middle west that collects all household refuse without a direct charge to the householders." Twenty-one $4\frac{1}{2}$ yard horse-drawn vehicles are used, collecting from more than 20,000 homes over an area of 46 square miles, making 3 collections a

MASTER of SNOW



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FIFTEEN	\$1450	FIFTY	\$3675
TWENTY	\$1900	SIXTY	\$4175

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T R A C T O R

week in the congested area and 2 a week elsewhere.

During the year ending March 31, 1931, the department collected 5,652 loads of garbage, estimated to weigh 8,478 tons, and 10,178 loads of rubbish and ashes, estimated to weigh 17,810 tons; also 3,175 dead cats, dogs and other animals. The garbage is fed to hogs.

The expenses of the department totaled \$50,816, of which \$49,994 was pay roll, \$161 was for gas and oil, \$182 auto expense, \$19 supplies, and \$459 miscellaneous. This gives a cost of \$1.933 per ton, or 63.5 cents per capita.

How New Bedford Solves Its Garbage Problem

(Continued from page 16)

Collection costs, which include all expenses and compensation, are as follows:

	Collection Costs		Incinerating Costs	Total coll. & incin. costs
	Total	per ton	per ton	
1928	\$145,560.97	\$6.19	\$2.67	\$8.86
1929	133,159.76	4.87	2.23	7.10
1930	118,737.70	4.10	1.90	6.00
1931	116,000.00	estimated for year ending Nov. 30.		

These figures include all administration, personnel, outlay, compensation and other expenses of the incinerator department. Comparing the year 1930 with 1928, collection costs were reduced \$2.09 per ton; disposal costs \$.77 per ton, reducing total costs \$2.86 per ton, or 32 per cent.

All work of an upkeep or maintenance nature incidental to the plant is done by the incineration staff. The two men who remove ashes each morning are occupied the remainder of the day with this work, which includes painting, keeping up the lawn and shrubs, leveling the ash dump, maintaining the driveway, and such. Occasionally throughout the year, furnaces are switched so that one or possibly two may be cleaned and repaired if necessary. The total expense of supplies and upkeep runs approximately \$0.032 a ton.

Sanitary Refuse Dumps

It is suggested by "The Surveyor" (England) that, in the present effort on all sides to save funds, dumping (or "tipping," as the English call it) may continue to be used by many cities for disposal of refuse until incinerators or other better means can be adopted. In view of this, it offers the following condensed suggestions for making such service as sanitary as possible.

As regards the higher control, careful consideration should be given to the question of the minimum distance from dwellings at which the refuse may be tipped, the 500 metres prescribed in Germany providing, perhaps, a basis for the discussion of this point. The maximum allowable thickness of layers of refuse, the minimum depth of earth coverings, when intermediate or when final, and the question whether, in the case of fairly deep progressive filling from one edge, the slope left at the end of a day's tipping should be covered with earth, all require to be considered in the light of experience and expert advice. The formation of mounds of earth-covered refuse, an occasional practice in Germany, is probably undesirable, on theoretical or common-sense grounds, in regard to the very much slower rates of decay of various materials when embedded in such mounds, as compared with those of materials in flat or hollow places; as well as for the reason that the most successful practice in controlled tipping in this country

has been in the filling of swampy or of low and damp areas.

As regards the immediate and detail control of the operations, it may be pointed out that the removal of large and bulky articles as the loads are tipped, the stamping flat of tins and smashing of large bottles and jugs, the spreading flat of linoleum and similar measures, point to there being scope for more elaborate but, in the end more economical, adjuncts to controlled tipping. A portable refuse destructor, provided with a ramp such as is fitted to railway horse-boxes, for the raking and pushing of combustible and loosely lying materials to some kind of elevating device which would feed it to the furnace, might, one would suppose, usefully be employed, the clinker coming in handy for cart tracks and other purposes. For the suppression of fires and slow smoulderings which emit objectionable smoke and fumes, fine dust, or powdered earth might be kept in readiness. By such and similar means, controlled tipping might be rendered more frequently an admissible expedient or an acceptable means of land reclamation, but the further and more fundamental principle is that of employing, by recourse to some trenching of the area if necessary, larger proportions of earth and deeper final earth coverings.

Refuse Disposal in Los Angeles

(Continued from page 29)

year, in pounds per person per day, averaged by months, is shown in one of the accompanying curves. From a minimum of 0.45 pound in September, 1918, it rose to a maximum of about 0.9 pound in September, 1929, to fall again to 0.8 pound in July, 1930, since which it has been rising slowly again.

The cost of collecting garbage is calculated in two ways—the cost in dollars per ton, averaged by months; and the tons collected per fixed unit. The results for thirteen years past are shown by the curves. In the top pair of curves, the solid line shows actual cost in money. The broken line shows the cost if wages and prices of materials had remained the same as in August, 1919. These costs include interest at 6% on the investment and depreciation of plant.

In the curve below, the fixed cost unit used is the work of one man, items other than labor being reduced to their value in terms of days work at the prevailing wage. The cost of all items of expense are included. This eliminates fluctuations due to variations in the wage rate. The base wage rate was \$3.00 up to August, 1919; \$3.25 for the next six months; \$4.25 until July, 1923; \$4.50 during the next year; and \$4.75 since July, 1924.

Still another curve shows the number of tons collected per man per month, based on the total garbage department payroll. The effect upon the curve of the full garbage pail is indicated by the peaks which occur each summer during the melon season.

Domestic non-combustible rubbish is purchased from the city by a local company, which sorts out bottles and other salable articles, recovers the tin from tin cans and sells the steel, in bales, to the iron and steel industry. The combustible wastes are delivered by the licensed collectors to the municipal incinerator, which destroys between 4,000 and 5,000 tons a month, at an average cost of a little over a dollar a ton, or about 75 cents for salaries and wages only. The collection and disposal of garbage and rubbish are under the jurisdiction of the city engineer, J. J. Jessup, and Ralph W. Stewart, chief deputy.



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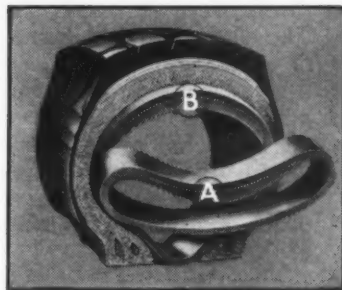
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In illustration (A) shows cross section uninflated, (B) inflated. The patented cord insert makes the Air Container's ability to seal punctures permanent.

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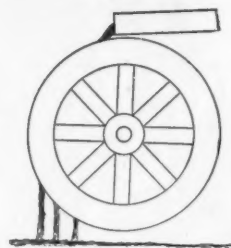


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THE WATER WHEEL

By
Jack J. Hinman, Jr.



Construction
AMONG the many public construction projects which have been suggested as a means of relieving the present economic situation has been the laying of water mains. Lowell, Mass.,ⁿ²⁷ has managed to give employment to 2300 men in daily averages of 125 while putting in a line of 22,000 feet of 20" and 22" cast iron pipe. It has been intimated that the cost was increased about 20%.

Alexander Potter⁹⁵ calls attention to the fact that **longevity of pipe lines** is not so much to be desired as maintenance over long periods of time of the **carrying capacity** of those pipe lines. Corrosion of the pipes by roughening the interior and by reducing the effective diameter of the pipe reduces the carrying capacity. Suitable lining or coating of the interior should reduce such corrosion. A British process of scraping and **electrical recoating of mains** in position has been reported⁶⁶. The coating is of a bituminous character.

The tuberculation of mains is very largely effected by the **iron bacteria** in the opinion of Reddick and Linderman⁸⁷ who have succeeded in recovering the organisms from many deposits. Sometimes the iron deposited seems to have come from the water and sometimes from the metal of the pipe. In either case the delivery of water is seriously impaired in time. The degree of the deposition as related to the amount of pipe friction has been studied by Clark⁵⁰ who has devised a nomographic chart which he calls a "**flow powergraph**" to indicate the power losses involved. At Phoenixville, Pennsylvania, corrosion of the pipe lines had gone on for 59 years and tuberculation had developed to such an extent that the **cleaning of the mains** very materially increased the carrying capacity of the system.ⁿ³

Other recent papers on corrosion:

A.W.W.A. symposium on **pipe corrosion and corrective measures**⁴⁹.

Recent development in **corrosion prevention**, Kendall and Speller⁸⁰.

Corrosion in **steam and condensate lines**, Mumford³⁴.

Corrosion of **heating boilers**, Nigh³³.

The discussion of the use of **cast iron pipe in lengths longer than 12 feet** at the A.W.W.A. convention in Pittsburgh last June developed the fact that pipe less than 8" diameter failed most frequently as a beam, above 8" as a ring, and at the 8" diameter about equally in one way or the other when failure actually took place⁵⁴. The physical properties of the pipe, the handling weights and the overall economy were discussed. A similar discussion on **lead versus joint compounds**⁵² was very favorable to the compounds. Men-

The essential features of important articles of the month having to do with water works design, construction and operation and water purification, arranged in easy reference form and condensed and interpreted by a leader in the water works field. Published every month to include articles appearing during the preceding month.

tion was made of the use of cement joints extensively employed on the West Coast.

At Endicott, Massachusetts, a 610 foot **river crossing** with ten inch cast iron pipe was accomplished in an interesting manner by five men of the reg-

ular force in three days timeⁿ²⁸. Rapid construction through **swampland** of 26 miles of 36" Lockjoint cement pipe was facilitated by the fact that much of the work on the joint could be carried out on the inside of the pipe⁹⁰. **Brooklyn** is installing 2600 feet of 72" conduits.

Current practice in **service piping** was presented by James E. Gibson following receipt of responses to questionnaires⁴². Considerable diversity of procedure is noted throughout the United States and Canada. Lead and copper are the preferred materials, with a probability that copper is coming to be recognized as generally the best. Maintenance of the service piping within the street line by the water department, as well as the making of original installation by the department itself, seems to be the general preference. The Metropolitan Water Board of London has recently restated its policy⁸³ in favor of such construction and maintenance.

Sandspun pipe is being produced in Great Britain at the Stavely works⁶³. An **asbestos cement pipe** of British manufacture known as Everite pipe⁷⁶ has been discussed at length.

Other Papers of Special Interest:

Lining of tunnels for carriage of water, Barnett⁶⁵.

Byzantine aqueduct still serves **Constantinople**, Smith¹⁸.

The production of water in the **Irish Free State during 1929**⁶⁹.

Trends in water works **operation**, Learned¹⁷.

German **rate controllers** of venturi type, Eggers³².

Unusual **reservoir design** for White Plains, N. Y., Knox⁸⁸.

Water Supply dam in Ozarks for **Springfield, Missouri**, Gray⁵⁵.

Flood control of alluvial rivers, II, Tibbets²³.

Non Shock water pressure ratings opposed Hoffer⁵¹.

Gate valve experiences and design, Van Loan⁴⁷, Gayton⁴⁸.

Self-priming British centrifugal pump⁶⁷.

Synchronous motors economical for constant speed pumps, Beardmore⁵⁷.

Propeller type **water turbines**, Paul⁷⁹.

Difficulties in **drilling wells in quicksand**³⁶.

Roswell artesian basin has world's **largest artesian well**, Day³⁵.

Plant Descriptions:

Waukegan, Illinois⁵⁶; Lockport, N. Y.⁹³; Hartford,



Photo Courtesy Jernigan Photo Service

201 miles of DELAUDAUD PIPE in the water system of Fort Worth

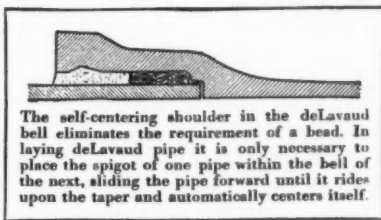
Fort Worth, Texas, is recognized as one of the most progressive centers of our great southwest. Here are wide, modern streets flanked by handsome municipal buildings and tall skyscrapers. Here are large modern hotels, theatres and schools. And, beneath the streets of this modern city, more than two hundred miles of deLavaud water mains are giving splendid service.

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DeLavaud Pipe is light in weight too; easy and economical to handle. It is remarkably satisfactory to cut and tap, and it offers approximately 5% greater carrying capacity for the same outside diameter. The illustrated deLavaud Handbook gives detailed information. Write for free copy.



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Conn.⁹¹; Bermuda^{24, 60}; Llanelly Gwendraeth Valley Reservoirs^{20, 61, 82}; Coventry, England⁷⁰; Belfast's Silent Valley Reservoir⁶⁴; Godalming, England⁷²; Preston's Aston Reservoir, England⁶²; Pymatuning Dam near Johnstown, Pa.³⁰; Patjal dam in Java⁷¹.

Milwaukee has completed the installation of a **high pressure fire protection station** to take water directly from the river and feed it through special mains to protect an industrial area⁷². Three 2500 gpm. pumps capable of pumping at 300 pounds pressure are installed. In Pittsburgh a high degree of complexity of **zoning** and piping is necessary according to Kennon⁴⁴ in order to take care of the differences in elevation produced by the city's rugged topography. Indianapolis has found large **elevated storage tanks** of assistance in supplying water to a distant section during hours of peak demand⁹⁷. The Eastbourne Waterworks Company has installed a very **artistic water tower** at Friston, on the South Downs of England⁶⁸. The tower will be a prominent object on the horizon seen for many miles. **Linings for steel water tanks** frequently cause difficulty either through lack of permanency or through production of tastes in the water held in them. The recommendations of the American Railway Building and Bridge Association discuss linseed oil paints, various asphaltic coverings, petroleum jellies and cement grout⁸¹.

Operation

Operation of **water purification plants in the drought areas** taxed the ingenuity of plant operators to the fullest extent during the year just past. Tisdale⁹ describes many of the situations which had to be met in **West Virginia** and adjacent states and which led to the gravest emergencies. At **Elkins, W. Va.**,⁸⁹ the Tygarts river, which is the normal source of supply of the city, failed completely. An emergency supply was pumped into the river from the Cheat river through a pipe line laid in a railway tunnel and this supply had to be continued for a period of about two months. The **heavy loads of sewage** in the rivers draining the area produced growths of algae and contributed to the difficulties of the water operators¹⁰.

Most of the plants in the drought area were able to produce water which met current bacteriological standards, but the **taste** of the water was extremely bad in a number of instances and few supplies were without objectionable tastes throughout the period. In October, 1930, an **epidemic of gastrointestinal disease** developed in Charleston, W. Va., followed by similar outbreaks farther down on the watershed of the Ohio river. The epidemic apparently reached Louisville about January 25th, according to Veldee¹¹. It is thought that the trouble was not due to any bacterial contamination of the water, if the water really was to blame, but that some **intestinal irritant** was responsible. There were no reported deaths. The illnesses were comparatively mild, lasting from a few hours to three or four days. Veldee believes that whatever the substance was, and assuming that it came from the water, it must have arisen in the Great Kanawha valley. Ravenel⁸ points out that in addition to troubles with water supplies and sewage disposal, the drought by bringing food shortages and economic distress would also cause **nutritional disorders**. **Typhoid fever** did not increase materially in most localities and in Tennessee there was a drop in the number of cases of **malaria**.

The situation developed along the streams in the coal mining areas also involved additional difficulties with **acid waters** from the mines. An excellent review of the acid mine drainage situation has been prepared by Drake⁴⁵. Investigations by Leitch^{14, 15} were carried

out in Pennsylvania for the bureau of Mines. **Manganese** is also encountered in annoying amounts along with iron and acid in the mine drainage according to the experience of Carpenter⁷.

Manganese and aluminum salts are more or less completely removed by **zeolite softeners** with some damage to the base-exchange mineral. Adams has shown that aluminum⁷⁷ is more objectionable than manganese⁸⁴ because it is more difficult to replace the aluminum when regenerating the bed of zeolite with brine. Synthetic base-exchange compounds are more likely to be injured by the aluminum and manganese compounds than are the glauconitic materials. **Salt waste water** from oilfields is believed to be ruining domestic wells in Orange County, California²⁵. In other localities salt water appears to underlie sweet waters and to be drawn up if the latter are too heavily pumped⁹⁰. Salt waters from wastes seem to be the most important limiting factor for the number of cycles possible in the **purification of sewage to drinking water quality**²⁶. The **electroösmose apparatus** offers a possible means of reducing the concentration of the chloride where absolutely necessary³⁷.

Avoidance and elimination of **tastes** in waters continues to attract much attention. Hansen⁴⁶ discusses the various current means of reducing annoyance from this difficulty. Baylis⁸⁵ has begun an extensive study of the employment of **charcoal and activated carbon** in water purification. The use of activated carbon for taste removal at **Norfolk and Newport News, Virginia**, was highly successful in the opinion of Fitzgerald⁸⁶ though fed in different ways at the two plants. Harkam and Greaves²² recommend filtration through activated carbon to remove the tastes imparted to chlorinated water that has passed through **creosoted wood stave pipe**.

Other Papers of Special Interest:

Treatment of water at **Appleton, Wis.**, Hall².

Iron removal at **Kokomo, Indiana**, Stradling⁹⁶.

Water softening at Birmingham, England's, power plant⁷⁴.

Troubles of a **filter operator**, Glace¹⁶.

Business of operating a municipal water works⁵.

Water Rates and Regulations, VII. Conclusion⁶.

Economy of universal metering, Johnson⁴³.

Rates charged consumers outside of the city⁵³.

Ownership of water rights, Parker⁹⁴.

Investigational

The field and scope of the science of **hydrology** has been ably summed up by Robert E. Horton⁷³. In Great Britain the survey of the **River Tees** carried out by the Government's Department of Scientific and Industrial Research has received very favorable comment^{21, 75}. It was noted as a result of current measurements that sewage put upon the bottom of the river would be retarded in its reaching the sea. The maximum velocities were found at depths of six to twelve feet as the stream approached its outlet to the sea. The bottoms of **deep lakes** may have their temperatures below 4°C. which is usually considered the point of maximum density of water, though the effect of pressure on maximum density has been known for about half a century. Various deep lakes may have bottom temperatures of 3.8 or 3.9°C. and investigators are warned by Wright that they should not distrust their apparatus because such temperatures are shown⁵⁸.

Dr. Harrison S. Maitland is reported by Science⁵⁹ as of the opinion that **radioactive waters** are dangerous if they contain too much radium. It is feared that an

(Continued on page 62)

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The great sewage disposal plant shown in the photograph is a typical installation of Norton Porous Plates.

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HIGHWAYS

and

PAVEMENTS



How Narrow On Curves?

By D. Y. Bate

Junior Civil Engineer, City of Los Angeles, Calif.

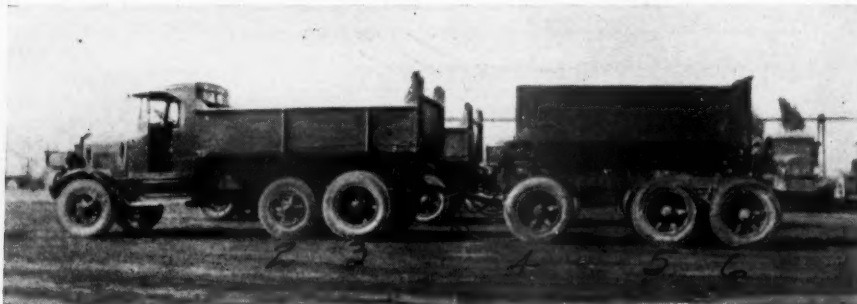
IN THE September issue of PUBLIC WORKS, under the title "How Wide On Curves?", the writer gave data ascertained from the various highway departments, with conclusions drawn without any tests having been made. In October, 1931, he made the experiment described below with a view to learning how narrow a pavement on a curve could be and still carry the wheels of a truck and trailer passing around it.

The experiment was made in the truck storage yard of the Consolidated Rock Products Co., of Los Angeles, through the courtesy of that company. The vehicles used were a GMC truck and a trailer, with air connections for braking the trailer. The wheels on this outfit will, for the purpose of this article, be numbered from front to rear in the order of procedure. Nos. 1 and 2 were single tread, 3, 4, 5, and 6 were dual treads. The tread of the front wheels was 6.17' and that of the rear of the trailer was 6.4'. The distances between the axles was as follows:

No. 1 to No. 2—11.00' No. 1 to No. 5—29.80'
No. 1 to No. 3—14.75' No. 1 to No. 6—33.33'
No. 1 to No. 4—23.65'

Arcs of radius 100', 75', and 50' were laid out by setting nails on the arcs and then stretching chalk line along them to make them more easily seen by the driver who was requested to consider this chalk line as the traffic marker on the center line of a street and

*On these arcs, soft material was encountered where the rear wheels obliterated the trace of the front wheels and their positions had to be measured from the center of the arc. The missing data were caused by a truck interfering with the taking of a straight-line measurement.



The battle fleet in which Mr. Bate sailed forth to make the practical tests outlined in the accompanying article.

drive accordingly. The traces of the wheels on the arcs were as follows:

Radius in feet	Wheel numbers and distances from center line of arc			
	1	3	4	6
100	92.2	91.5	90.65	90.00
75*		74.8	74.6	74.2
50*	42.75	42.70		41.20

After driving around these arcs, the driver cramped his wheels as short as possible, and the trace of the rear wheel of the trailer was measured and the radius of the arc calculated. The radius of this shortest possible arc was calculated to be 25.43', with a spread between the front and rear wheels of 3.1'

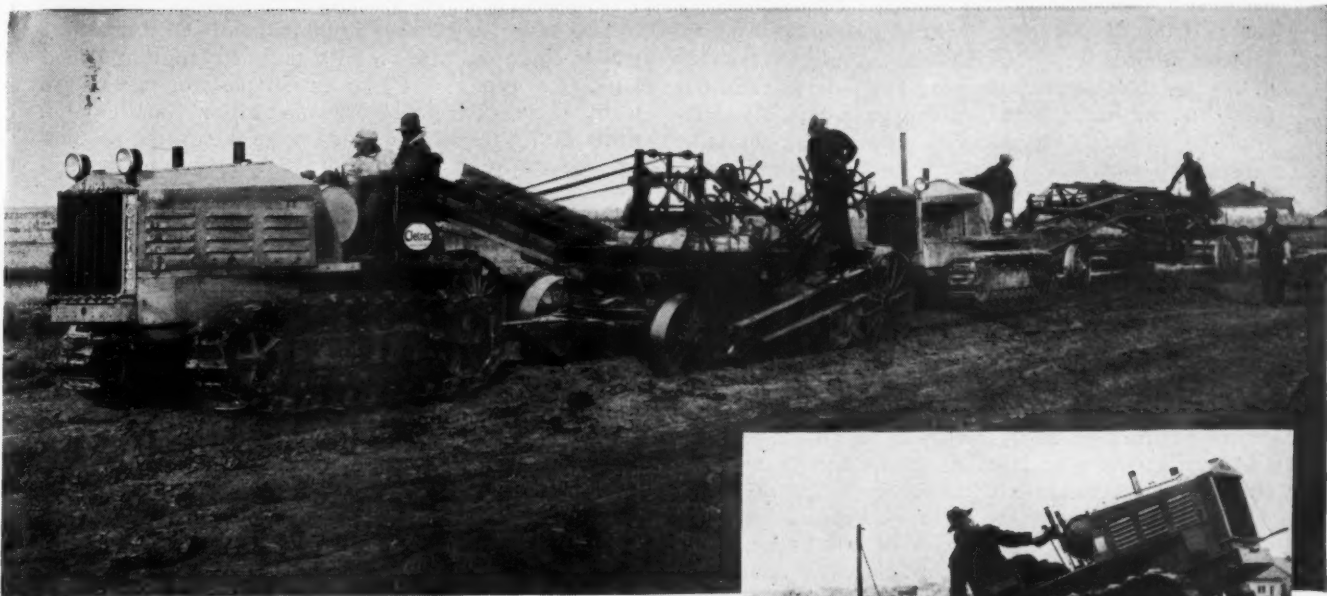
Since making this experiment the writer is more than ever convinced of the correctness of the conclusion given in the article "How Wide on Curves?"—that, by using the formulae of the California Highway Department to attain the transition from the normal to the widened curve, and with the 6.5' as designated by the Missouri Highway Department on the curve of 25' radius, gradually decreasing to 4' on the 100' radius and thereafter following the standards of the California Highway Department for widths, the ultimate in traffic safety has been taken care of by the designer, both on urban streets and highways.

A later experiment was made to determine how wide a depression in the curb was necessary to allow a gasoline tank truck and trailer to get into a service station and to the pumps. This truck and trailer measured from front axle to rear trailer axle 35.16' and took 38' of depressed curb.

The details of this experiment will not be given, only the results, as they may be of some use to the municipal engineering fraternity.

Single-Lane Pavements

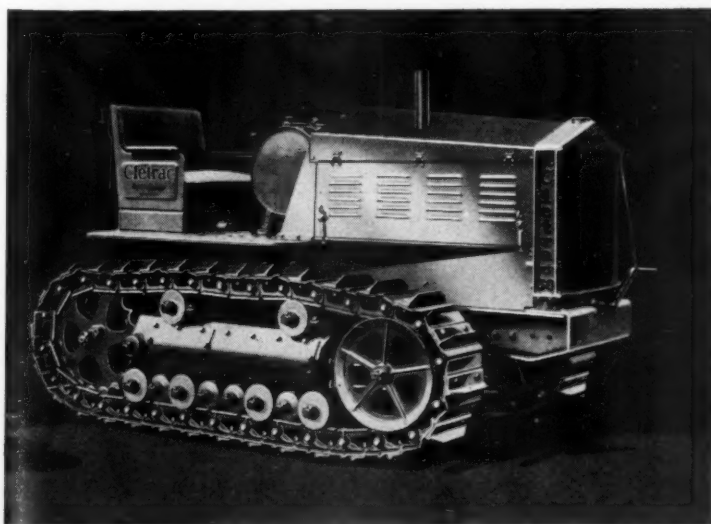
Two vehicles can not pass on a 10-foot pavement, and as second-class roads can not well be used as one-way thoroughfares, single-lane roads would be of little use. But a single-lane pavement, with one or both shoulders sufficiently firm and wide to permit passing when it infrequently becomes necessary, affords the advantages of a solid, smooth pavement for a very large percentage of the time to any vehicle using the road. The cost, while greater than that of a road all of gravel or other non-solid material, is less than that of a two-lane



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concrete or asphalt pavement. In Iroquois County, Illinois, where aggregate must be shipped in, the cost of single-lane concrete this year was only \$13,720 per mile, and in Bay County, Michigan, where all materials are at hand, the cost was only \$9,000 per mile.

Thirteen states let contracts this year for approximately one million square yards of single-lane concrete pavements 8 to 10 feet wide—about 200 miles—according to the Portland Cement Association, which states that this brings the total mileage of single-lane pavement in the United States to about 2,600 miles. Missouri alone awarded nearly 40 miles of single-lane pavements, and widened others previously built.

It would appear that there are no more accidents on single-lane than on double-lane pavements.

R. F. Fisher, superintendent of highways for Champaign County, Illinois, where 148.49 miles of single-lane pavement are in service, says that accidents are infrequent on these pavements and that on football days, when upwards of 500 cars an hour are carried on them, very few mishaps occur.

Single-lane pavements are sometimes used as stage construction until money is available for full-width paving, but are more often built as permanent improvements on rural roads that carry little or no through traffic and local traffic flows of 50 to 500 cars a day.

Portable Light for Night Work

By Chas. N. Tunnell

A Texas contractor on concrete road construction found that it required almost twice as long to lay the forms and make ready as it did to pour the concrete, which caused quite a bit of confusion in the work. To solve this problem he decided to use a night shift for the former class of work, and to permit of this he used a regular portable 800-watt lighting system such as is used on farms in that section of the country.



Portable lighting plant for night work on highways.

This equipment was mounted on a four-wheel trailer equipped with an adjustable rectangular frame built from pipe. The four corner posts or pipes were made of two-inch pipe eleven feet high. Smaller pipe to fit within the two-inch post were then fitted to slide up and down at any height from twelve to twenty-three feet.

A large spotlight with a 500-watt lamp was fitted to one end of the portable lighting system, while two 100-watt lamps were placed on the frame for lighting opposite directions.

By raising or lowering the adjustable frame, the light beam may be given any radius with excellent light up to 300 feet.

Locating and Planning Low-Cost Roads

In planning extensions of our national highway system low-cost construction has become an important factor in decreasing the vast mileage of unimproved highways. In the future it must play an even greater part if a continuous transportation system is to result.

The following suggestions which summarize the most recent practices in low-cost road construction are made by a committee of the ARBA.

1. Highways of general motor use should be financed by users of the highway-gasoline tax and registration fees.

2. Highways of local use only should be financed, in part at least, by local taxes or special assessments, limited by the benefits resulting from the improvement.

3. When there is an urgent need for highways and a fixed income exists, bonding is recommended. After the initial construction is completed programs may be carried on by use of current funds and in special cases augmented by small bond issues.

4. Funds for construction of low-cost roads can be greatly increased by the elimination of much unproductive mileage.

5. Consolidation of poorer, sparsely populated counties will combine resources and make funds available for necessary highway improvements.

6. With approximately 2,000,000 miles of highways in the United States yet to be improved, the popularity of low-cost road construction will increase rapidly.

7. Township and highway districts within counties should be eliminated as highway supervising units—these highways should be administered through efficient county highway engineering departments.

8. The state aid system, which should comprise the county trunk-line system, should be financed by state and local funds and supervised by the state.

9. When the state system has been improved sufficiently to satisfy transportation demands for passable connecting highways, county trunk highways should be selected to receive a portion of state funds for construction.

10. Where county financing is done by bonding, serial bonds should be utilized with a retirement period not to exceed 20 years. The bonds should be sold as the proceeds are expended.

11. As approximately 75 per cent of highway construction costs go to labor, the construction of necessary highways in outlying regions is particularly recommended. Construction activity of this nature does not remove labor from its source and furnishes relief in areas where it is most needed.

Traffic Survey of Washington, D. C., Area Begun

On September 10, 1931, the Bureau of Public Roads in cooperation with other agencies, inaugurated a survey of traffic on the principal highways in the area immediately adjacent to Washington, D. C. The cooperating agencies are the National Capital Park and Planning Commission, the District of Columbia, the Maryland State Roads Commission, the Virginia Department of Highways, the Maryland National Capital Park and Planning Commission, the city of Alexandria, Arlington and Fairfax Counties, Virginia; and Prince Georges and Montgomery Counties, Maryland.

This is the first comprehensive survey of the area surrounding the city of Washington. It is expected to yield information essential to the solution of traffic problems in this region. The general purpose of the survey, according to the agreement signed by the cooperating agencies, is "to secure facts and obtain information which will enable the agencies concerned to develop a comprehensive, systematic, and connected system of main highways within and between the areas of Fairfax and Arlington Counties, Va.; the city of Alexandria, Va.; Montgomery and Prince Georges Counties, Md.; and the District of Columbia, including a study of proper connections with the Federal-aid highway systems of Maryland and Virginia within these areas, and such other adjacent areas as may be affected by a general highway plan for the environment of the District of Columbia. The surveys will be directed toward the development of a priority program of highway construction and betterment in the entire area and toward fixing the location and connections of suitable belt lines, relief roads, or necessary relocations and extensions of existing highways. They will include a highway traffic census to determine the origin and destination of various kinds of vehicles, the preparation of a comprehensive report, and an analysis of the information obtained, for the guidance of the officials concerned in the various jurisdictions."

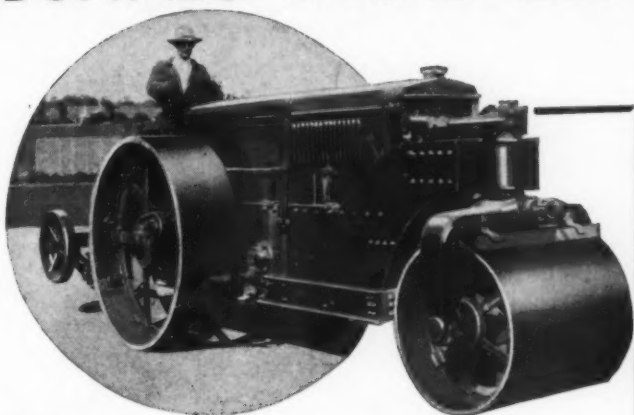
Federal Aid for Roads Available in Advance

Most of the \$125,000,000 authorized by congress for the year 1932-1933 has been made available at once and apportioned to the states to aid unemployment. The Bureau of Public Roads will agree to the use of this for work wherein contractors are required to pay a fair minimum wage and give preference to local unskilled labor, or restrictions are made as to hours per day and days per week per man, to spread the employment; also, where legal, for direct employment of labor, provided the work is done economically. But the bureau will not consent to refusal to award contracts to non-residents of the state or to limitation of materials to those produced within the state.

Rhode Island's Washington Highway

In honor of Washington's 200th birthday anniversary, to be celebrated next year, the State Board of Public Roads of Rhode Island will dedicate a new Washington Highway which will be 25 miles long and cost about \$800,000, including \$400,000 for five bridges. It will connect with other highways, forming a belt highway, which probably will be the first belt highway named in the first president's honor.

BUFFALO-SPRINGFIELD

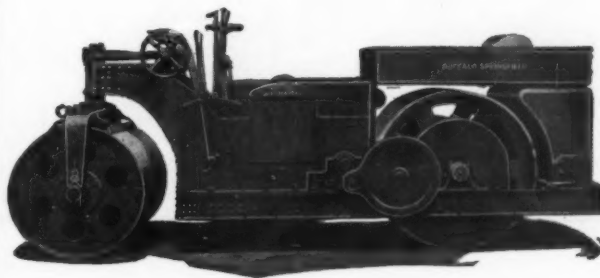


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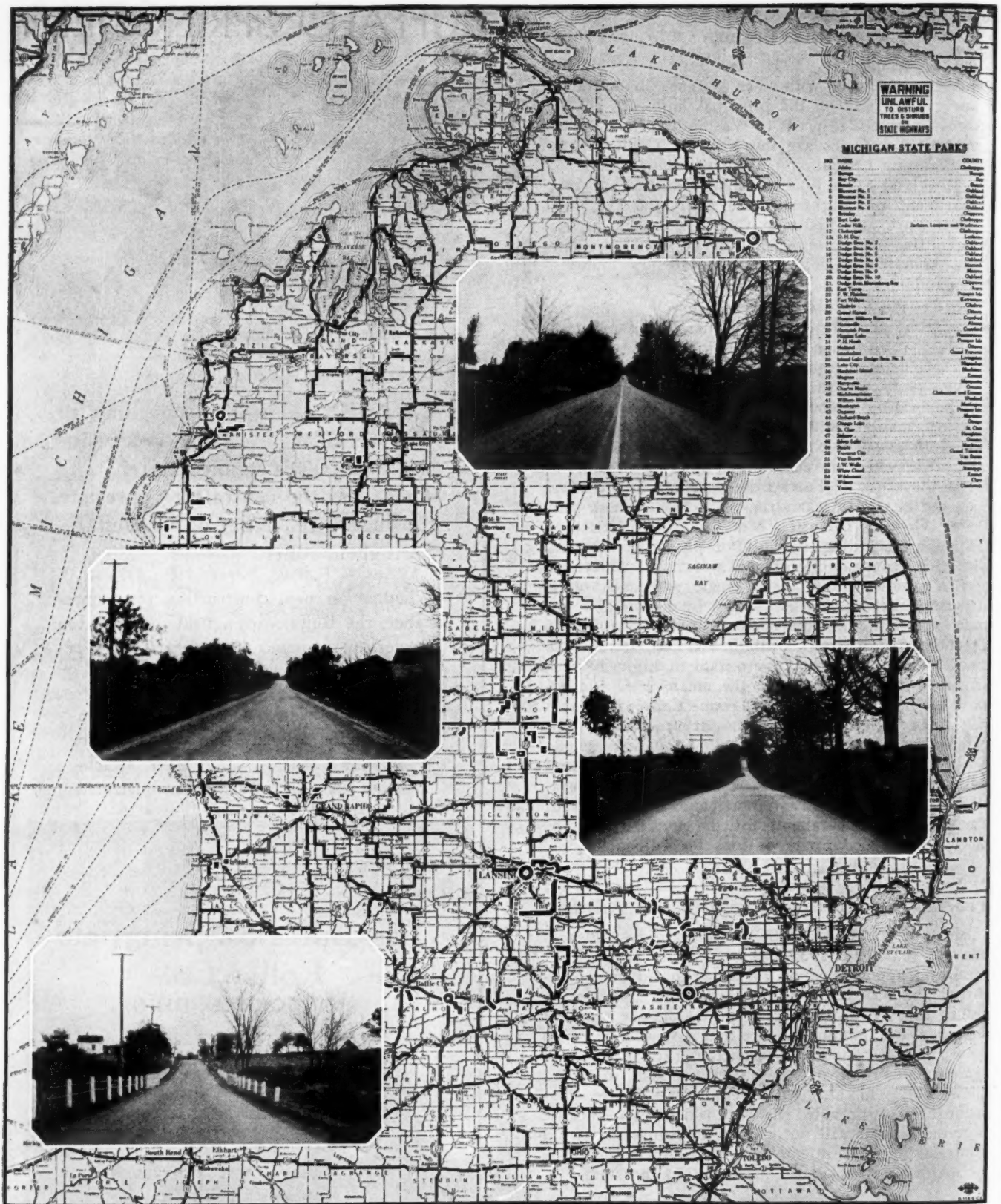
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4. *Smooth, durable riding surface.*
5. *Labor and material used in construction are available from local sources to the extent of 95%.*

In two years time, the counties in Michigan have constructed 200 miles of low cost improved roads. In building these roads 15,000 gallons of Standard Asphalt Road Oil and 880 cubic yards of gravel were used per mile of 18-foot width road. The road oil and gravel were mixed on the road with ordinary disc harrows and blade graders.

This type of construction has become a standard one in Michigan because it has proved successful. Many highway officials in other states in the Middle West have testified to the economy of and satisfactory service from roads constructed with Standard Asphalt Road Oil.

If you want to know more about the cost of building roads by the method given above, write for specifications and recommendations:

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Fillers and Cushions for Block Pavements

Fillers

THE requisites of a good filler are: It should hold the blocks firmly in position; remain permanently in place; afford support to the edges of the blocks and thus prevent chipping and consequent rounding of the heads of the blocks or bricks. Moreover, it should be easy to apply, reasonable in cost, and a material which will permit traffic directly after it has been placed in the joints of the pavement.

Asphalt mastics when properly made and applied seem to satisfy the above requirements the best of any material now in use. However, in the case of brick pavements when the bricks do not have lugs to space the courses, it has been found difficult to obtain a thorough penetration of the mastic into the joints, and consequently a straight asphalt filler has been used very generally. This has resulted in more or less trouble in warm weather, as the filler then softens and swells out upon the surface of the pavement and becomes "sticky" under traffic. When lug brick are used, or "spacers" are employed to separate the courses, an asphalt and sand mastic has been used with very satisfactory results.

The mastic most widely used for stone block fillers is the one in the standard specifications of this society, in which the asphalt has a penetration of 60 to 70 at 77 degrees Fahrenheit, to which is added dry, hot sand, all of which will pass a 10-mesh sieve and not less than 85% pass a 20-mesh sieve. The more sand that the mixture will carry and still flow into the joints readily, the better the resulting filler; 50% is about the maximum amount of sand that the asphalt will carry and still flow properly.

This filler has proven satisfactory in most cases when heated to the right temperature and kept there until flushed over the surface of the pavement. In spreading the mastic into the joints, it is very important to have the tools properly heated and changed for freshly heated tools with sufficient frequency. It is very essential that no more of the mastic be left on the surface than can be helped, and this can be effected only if the tools are kept hot. Some places are even going back to pouring, in order to keep the mixture off the pavement surface; however, in the case of stone block pavements when reasonable diligence is used in flushing the hot asphalt mastic over the surface and shoving it into the joints and off the surface with hot tools, the small amount that cannot be gotten off the pavement surface does no great harm but in fact is of some benefit in cushioning the low spots in the heads of the blocks until the traffic wears down the high points in the heads of the blocks and thus produces a smoother surface in time than when the pavement is first laid. Such a light film will readily be worn off by traffic and cause no inconvenience.

In some cases where the traffic is intensive and heavy, the above mastic has softened and come out on the surface in warm weather, but investigation has shown that this was due in large measure to the use of insufficient sand in the mastic. In the worst case coming under the observation of the writer, the records showed that an average of only 30% of sand

was used instead of 45% to 50% as should have been used. Under similar conditions of traffic, an asphalt having a penetration of 50 to 60 at 77 degrees F. is now being tried and when mixed with about 50% of hot sand by volume seems to flow into the joints about as freely as that having a penetration of 60 to 70. Either of these asphalts should give good results if properly handled. There seems to be more need for improvement in the workmanship and manipulation on the work than with the materials now in use.

Recently some pouring has been done with tanks on wheeled carts, but considerable trouble has been experienced with clogging of the outlet when chilled. A conical can having a needle valve and carried in the hands of a workman has been used in pouring joints in brick pavements and works fairly well with granite block pavements if hand pouring is called for. In the case of brick pavements a small tank on wheels has been used extensively, the tank having a conical bottom fitted with a needle valve, immediately behind which is a curved squeegee having a piece of rubber belting on the bottom edge. This has worked quite well, but when not used fairly continuously the squeegee would tend to gum up and require cleaning. On the whole, hand squeegees having steel blades which are kept hot are the most satisfactory and effective in avoiding a surplus of filler on the surface of the pavement when it is flushed over the surface.

After the joints have been thoroughly filled and the surplus mastic has been squeegeed off the surface of the blocks, a thin layer of sand or stone dust is spread over the surface to prevent traffic sticking or picking up the film, and also to aid in grinding off the coating.

Ready mixed mastics of asphalt and slate dust, limestone dust, etc., have been made commercially, and have been used to some extent in stone block pavements, especially in the states of Pennsylvania and New Jersey. For more than two years past, New Jersey has used in granite block pavements a mastic composed of asphalt having a penetration of 85 to 100 at 77 degrees F. and about 45% of slate dust by weight. The engineers consider that they have obtained better results with this filler than with the mastic using sand. Other prepared mastics contain various forms of mineral matter, but are similar to the above.

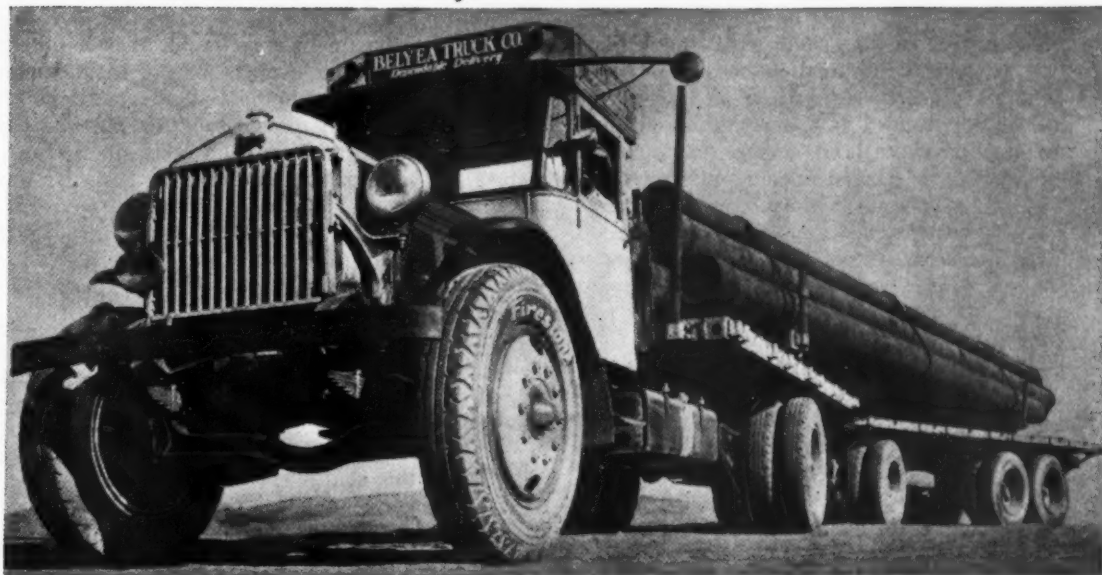
Various specifications have been used for the mastic fillers, but the one most generally used for the asphalt in the mastic for stone block pavement fillers is that of the American Society of Municipal Engineers, given in the Standard Specifications for Stone Block Pavements.

In joint fillers for stone block pavements the tendency today is towards as hard an asphalt as will flow into the joints properly when made into a mastic containing as much mineral matter as possible, usually as near 50% by volume as will flow, in case sand is used. The object is to make the joint as nearly as possible a narrow strip of rich asphalt pavement between the blocks.

Cushions

In all forms of block pavements, the sand cushion is still the one generally used. In the case of granite and other stone block pavements it is given an aver-

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age depth of one inch, or just sufficient to take up the inequalities in the surface of the concrete and the variations in depth of the blocks. When a cement grout filler is used, there is often an advantage in the use of what is known as a dry mortar cushion, consisting of one part portland cement to four parts sand or sometimes as rich as three parts sand. No water is added but it becomes moist from the water in the grout.

When an asphalt mastic filler is used in the joints, the so-called dry mortar cushion is sometimes used, but it is questionable if there is any material advantage in that case, for traffic is usually permitted over the pavement as soon as the filler is cold and consequently there is not much chance for the cushion to set before it is disturbed by traffic.

In some cases, such as on bridges where there was considerable vibration and it was not advisable to use either a sand cushion or a dry mortar cushion, a bituminous cushion has been used, as on the Harvard Bridge between Boston and Cambridge, Mass., where the cushion consisted of a hot asphalt top mixture which was spread only a very short distance ahead of the pavers so that the cushion would not become chilled before the blocks were paved. This pavement, after seven years of use, is in first class condition although the bridge, of cantilever construction, has great vibration and is a severe test for any pavement.

So-called "cold mixes" have been used as cushions on other bridges with varying degrees of success.

In conclusion, it is suggested that there is considerable room for improvement in both fillers and cushions, and especially in the fillers. The Borough of Manhattan, New York City, is about to try several forms of filler on the same contract to test their values. It may be that a combination of sand and fine mineral dust with the asphalt will give us an improved filler. These have been used separately and when applied properly have given good results, and it is possible that a combination may prove to be better and at the same time be more fool proof when the workmanship is not of the best.

Controlling One-Way Traffic Past Construction

In the good old days, when a road had to be repaired or reconstructed it was customary to fence it off with a big detour sign and let the motorist shift for himself. Sometimes an alternate rough road was provided for him through trees and fields.



"Check" Meyer and his control car.

The modern method of the California Public Works Department is different. It is founded on the policy of extending every courtesy to the motoring public. If possible only half of the road is closed at one time. When this policy was first put into effect, motorists, in trying to pass each other on the narrow strip, would occasionally get off on the soft, unfinished portion. To prevent this, at least one Division provides a "control car" to pilot the traffic through the one-way strip beside the new work. The illustration shows such car on the highway between Napa and Shellville.

Financing City Pavements

(Continued from page 31)

earth, sand-clay or gravel bases, they have most of the characteristics of the high-type bituminous concrete surfaces, except durability, and their first cost will seldom be more than 15 to 25 per cent as great. By using these low-cost pavements, many cities will be able to surface their residential streets, even in these periods of depression, and postpone the heavy first-cost for high-type construction until more prosperous times.

Fig. 2 illustrates a type of cost chart on city pavements. Such a chart should be used by the officials of every city. If based on reliable data and kept up-to-date from the records of contract prices in his own and nearby cities, it will enable the city engineer to advise not only the types of pavements to use, but also the time when paving contracts can be let at the most advantageous prices. The chart given indicates that cities might well begin paving programs now if it is at all possible for them to secure the funds.

Experimental Farm Roads in New York State

(Continued from page 17)

road construction, which comprises less than 40 per cent of the total mileage of the State, has been provided, but no method of assisting the rural people to finance the construction of the 25,000 miles or more of third class roads has been worked out with the exception of a contribution of about \$3,500,000 made annually by the State. This contribution, together with the amount of money that the towns are able to raise, is hardly sufficient to do the comparatively simple maintenance and drainage work on the earth roads, to say nothing of starting construction of improved types. It seems necessary that the State should devise some system of aid in the construction of town roads. Whatever system is devised should provide that the work be done under the direct supervision of the county superintendent of highways in much the same manner that the county road system is now being constructed and maintained, and that the State, through the Department of Public Works, should have some jurisdiction over the expenditure of the money. In other words, the town road system should be a secondary part of the county road system. This will be a preliminary step in the division of the entire road system into two general classes, the State and the county systems. We do not think it advisable to entrust the expenditure of \$125,000,000 or more to 933 town superintendents elected rather than appointed. The expenditure of this vast sum of money should be under the supervision of men trained for that type of work.

Paper for Curing Concrete Slabs

By Mark Morris

Research Engineer, Iowa State Highway Commission

Abstract of unpublished departmental report of Iowa State Highway Commission, furnished by the Highway Research Board, National Research Council.

As a continuation of the extensive study of methods of curing concrete undertaken several years ago, this Department during the construction season of 1931 investigated the use of two heavy duplex papers proposed by their respective manufacturers for use in curing pavements and concrete floors. These duplex papers are of similar construction, each consisting of two layers of heavy kraft paper sealed together with a thin coating of asphalt. In order to compete successfully on a cost basis with moist earth curing, these papers must be used several times, probably 5 to 9 times. At each application of the paper, samples of it were taken and given a rigorous test in the laboratory to determine its ability to prevent loss of moisture from mortar cured, for the first 24 hours after placing, under wet burlap.

From previous work on methods of curing concrete, it has been found that satisfactory curing requires that the concrete retain at the age of 6 days at least 80 per cent of the original water content. These papers showed losses varying from 0.61 to 4.29 per cent at the initial application of the paper to 2.00 to 7.87 per cent for the paper in the condition as found after the last application. Concrete losing this small amount of water in six days may be considered to have received satisfactory curing. Properly handled, therefore, these duplex papers were found to provide a satisfactory means of curing for concrete pavements.

Providence to Compare Lake and Oil Asphalt Pavements

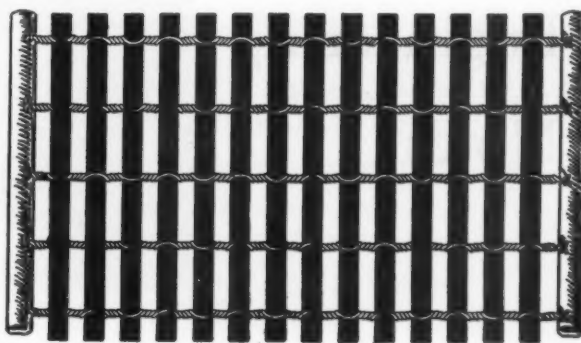
It has been more than fifteen years since Providence, R. I., laid any natural or lake asphalt. One local street, paved with natural asphalt in 1894, was not repaved until 1928. Another street, Broadway, was paved with lake asphalt in 1895, and, but for doing over some parts with the same material in 1906, remains in good condition to this day. Public Works Commissioner Frank Waterman has decided to try out the relative merits of lake and of oil asphalt over a period of years and will use lake asphalt for paving two important local streets, even though prices of the oil asphalt are lower. On Allens Avenue contract figures for the former are \$34,390 against \$30,620 for oil asphalt.

In the near future Mr. Waterman hopes to erect a plant which would enable his department to patch the city's asphalt streets, and dispense with hiring local contractors for this work.

Road Work in Japan

According to Mr. Masuki Fujii, Chief Engineer of Research Office, Public Works, Home Affairs, the Japanese Government has allotted about \$15,000,000 for highway construction this year, as a form of unemployment relief. Under this program high type surfaced roads are to be constructed as follows: Concrete, 60 miles; cold laid or emulsion asphalt treatment, 40 miles; penetration sheet or hot asphalt, 60 miles; and surface treatment with heavy oil, 20 miles. Generally the methods followed in construction and application are similar to those in use in the United States, except that hand labor is used whenever possible.

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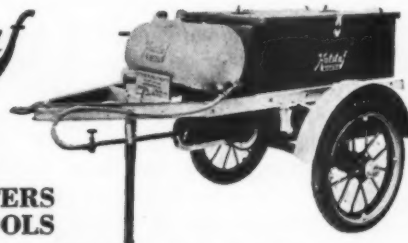
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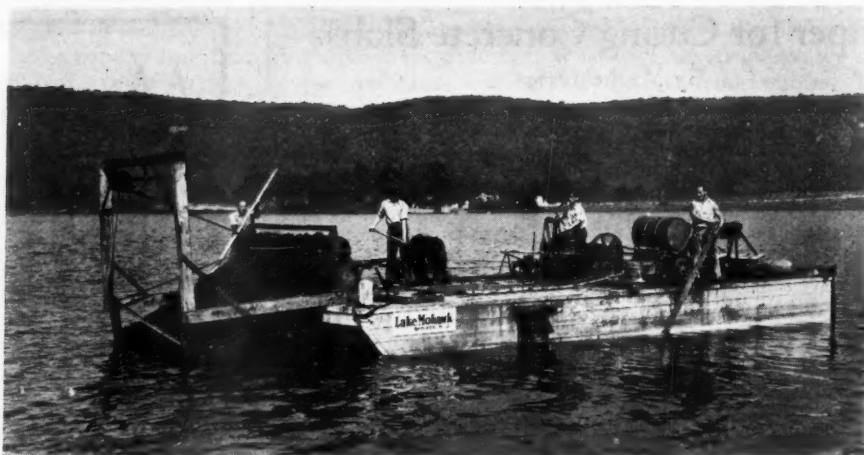


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Sanitary Engineering Notes



Plant for removing weeds from Lake Mohawk.

Removing Weeds from Lakes

A FLOATING appliance for removing weeds from the bottom of a body of water has been devised, constructed and used the past summer at Lake Mohawk, Sparta, N. J. It is described for us as follows by Harry C. Callahan, superintendent for the Arthur D. Crane Co., developers of the lake, to whom we are indebted for the photograph also.

The scow is 15 by 30 feet, draws 12 inches of water and extends 2½ feet above water. It is driven with a paddle wheel, and a 4-cylinder, 16 horsepower marine engine furnishes the power. The weeding machine is built on the conveyor type, using twenty-penny nails, staggered, as teeth.

The success of the scow is due to its easy handling, as a man with a pole can swing it in any direction, thus keeping a straight course and removing the weeds as a mowing machine does.

The hoppers on the side are used to hold copper sulphate for dosing the lake during the purging period.

This machine has been very successful in cleaning the weeds out of the lake, pulling them out by the roots, especially where they were thick. The scow was designed by R. Royal Roane, M.E., one of our club members, and the machinery and equipment were designed and built in our own plant.

Creosote Oil Destroys Filter Flies

EXPERIMENTS and the procedure developed therefrom for killing filter flies (*Psychoda*) at Huddersfield, England, were described in a paper before the Association of Managers of Sewage Disposal Works, in October, by W. D. Scouller, H. H. Goldthorpe and W. Watson.

Experiments were made on laboratory filters made with glass ends and covered with muslin to prevent escape of flies. When creosote was applied, the flies which had been resting on the clinker became excited at once, and a few seconds later those on the muslin were affected and dropped onto the clinker. In a few minutes the flies were out of action and did not recover.

The material used was a mixture of creosote oil and orthodichlorobenzene, or creosote oil alone. The addition of 10% of orthodichlorobenzene shortened the time required to rid the filter of flies from 41 days to 28 days. Whether creosote oil alone or the mixture was used, it was made into a stable emulsion with soap made from grease recovered from the sewage, and a

gallon of this was applied per 175 sq. yds. of filter area. In actual routine service creosote alone was used.

The emulsion was pumped to each filter and stored in containers connected to the feed pipes of the filters. The filter was rested for 30 minutes, then operated for 15 minutes with the emulsion entering the feed pipes and spread by the sprinkler over all the bed. The filter was then rested for two hours to enable the creosote vapors to act on the flies. The filters could not be withdrawn from service during the day, so the treatment was confined to night; and in some cases even then the rest periods were shortened.

"At the end of the first treatment of 39 days the flies had disappeared. The treatment was then stopped, but for security treatment was continued over the two next week-ends. The treatment was then stopped for 33 days, when the flies again appeared. Treatment was resumed intermittently.

"The total times of treatment given during the period May 1st to September 30th was 39 continuous and 20 intermittent times. The flies were under control after the first period of continuous treatment, and this confirmed the laboratory experiments.

"The treatment had no appreciable effect on the filter effluent. A black layer of slime was formed just under the filter surface. The treatment delays the sloughing of the filters, and this delaying action should not be extended into winter, otherwise ponding may take place before the spring sloughing is due.

"The object of the treatment was to find a method of controlling the liability of aerial nuisance. The treatment has been entirely successful in achieving this object, though it must be borne in mind that the summer has not been too favourable for flies. The treatment did not aim at the total destruction of the flies, because the larvae are necessary for breaking down the filter slime.

"The total cost of the spring and summer treatment for 10 acres of filters was £535 15s. 4d., which includes labour and chemicals. This works out at £53 11s. 6d. per acre per year."

This figures about 5 cts. per square yard of filter. In discussing the paper, H. D. Bell, of Barnsley, said he had used chlorine for fly control and, at a cost of 0.56 ct. per square yard per annum, had considerably reduced the number of flies and improved the effluent. Mr. Goldthorpe, however, said that chlorine would have cost more on their filter, for they had found that their tank effluent took up 20 parts of chlorine almost immediately, with very little reduction in oxygen absorption.

Pawtucket (R. I.) to Have Activated Sludge Plant

The City of Pawtucket, Rhode Island, has plans completed and accepted by the State Board of Purification of Waters for the erection of an activated sludge plant designed to serve a population of 100,000 persons. It will have two detritors, duplicate bar screens, three sedimentation tanks with mechanical sludge removal apparatus, two heated digestion tanks and 18 sludge beds. Chlorination of sewage will be provided. A laboratory will also be provided with equipment for measuring flow, pumping of sludge, and collection and burning of gases produced in the digestion tanks will also be done. The plant is to be completed by October 1, 1932 by order of the State Board.

Waterproof Walls of English Reservoir

In constructing a one-million-gallon reservoir at Kniveden, England, the engineer, W. E. Beacham, in order to secure water-tightness made use of an asphalt sheeting $\frac{1}{4}$ inch thick and about 5 feet square.

The floor was constructed of a bottom layer 9 inches thick, on this asphalt sheeting was laid with lapped joints sealed with cement and a surface course of concrete 6 inches thick, covered with a 1:2 cement mortar 1 inch thick with which was mixed 5 pounds of a water-proofing powder per 100 pounds of cement.

The outer walls are 5 feet thick at the bottom, stepped on the outside to 18 inches at the top. The inside of this wall was covered with the same asphalt sheeting, fixed to the wall by means of wall ties, one to every square yard of face, against which was laid a course of brick laid in cement mortar. Behind the wall was placed a layer of well-puddled clay which had been mixed in a pug mill.

Power From Sewage Gas

Experience of over two years with the generation and use of gas in sludge digestion tanks at Iserlohn, Germany, showed a yearly average of 0.33 cu. ft. of gas per capita per day collected. The gas was used to operate Deutz motors, which furnish power for the entire plant, generating 20 hp. from about 6,000 cu. ft. of gas a day, or one horsepower per thousand population. It is estimated that this effects a saving of \$1250 a year.

Water Purification Notes From St. Paul

The purification plant operated at an average rate of 58 per cent throughout the year. The maximum rate of operation for one month was in the month of August when the plant reached 84½ per cent of its rated capacity. The maximum rate for twenty-four hours was on August 6th when 43,100,000 gallons of water was filtered, representing 103 per cent of the rated capacity of the plant. The maximum hourly rate was 48,000,000 gallons or 114 per cent of the rated capacity of the plant.

Ammoniation—The last three months of the year ammonia was added to the water in the amount shown in the table. (The amount of ammonia gas used averaged 0.12 p.p.m., or about one pound per million gallons, equivalent to 3.4 pounds of ammonium hydroxide. The cost of the ammonia averaged 13 cts. per million gallons.) The addition of ammonia reduces slightly the amount of liquid chlorine required for sterilization of the water. In addition it has im-

In Modern Sewage Plants Separate-Sludge-Digesters

are used

SATISFACTORY OPERATION, HOWEVER, DEPENDS UPON

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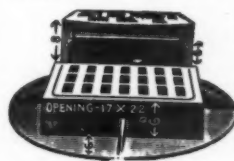
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proved the taste of the water and tends to eliminate all traces of odor and taste from the treated water. Ammoniation entails no additional expense for mechanical equipment since it is applied to the water in the same solution as the aluminum sulfate. The cost for ammoniation will increase slightly the cost for chemical treatment, but only a few cents per million gallons.

Rat Typhoid Opens New Research Field

Experiments performed under the direction of Dr. Lloyd Arnold, professor of bacteriology and preventive medicine at the medical college of the University of Illinois, and head of the Chicago branch of the diagnostic laboratories of the State Department of Public Health, indicate that rats and mice

are subject to typhoid fever. The germ or organism which causes the rodent disease is described as a first cousin of the germ which causes typhoid fever in humans.

The importance of this discovery lies in two directions. First, it opens up the whole rodent family as material upon which experiments can be performed in reference to typhoid fever. Secondly, it introduces rodents as a possible source of infection of humans.

The importance of rodents as experimental material in this field has been demonstrated. Mice and rats have been vaccinated against typhoid fever. The vaccine was given by mouth in some cases and by injection in others. Both methods gave equally positive results and the protection was highly successful in all cases of vaccination.

Bids for Boston Refuse Disposal

Bids for disposing of the garbage and other refuse of Boston were received on November 18th from five firms, ranging, for a five-year contract, from an average of \$450,000 to \$570,000 a year; and for a ten-year contract, from \$378,000 to \$511,500 a year. All contractors proposed to pay not less than 62.5 cts. per hour "for wages for laborers experienced on the class of work to be done under this contract."

The contract requires that final disposal of the garbage be by the reduction process. The city now owns land, wharves and buildings at Spectacle Island, in Boston harbor, which are now used for garbage reduction by the Coleman Disposal Co. under its ten-year contract which expires July 1st, 1932, which

property can be used by the successful contractor without charge, but it does not include the reduction process equipment, all of which must be provided at his own expense. The bids do not include collection but do include transportation of garbage from three mainland transfer stations to Spectacle Island. The ashes and rubbish are delivered by the city to the contractors' dumps.

Final disposal of rubbish is to be by dumping on marsh lands, flats or other suitable locations, or on islands in the harbor when properly bulkheaded to prevent its escape; this material to include catch-basin cleanings, street sweepings, grass, garden refuse and leaves, and automobile bodies, in addition to material generally classified as "rubbish." Clean ashes and other heavy material may be disposed of by dumping at sea.

Approximate Weights of Garbage and Refuse Collected Within Proposed Contract Areas, Year Ending December 31, 1931.

Districts	Estimated population	Garbage	Ashes and rubbish	Street sweepings	Material from catch basins
South Boston and part Dorchester.....	58,039	9,600	43,900	5,400	4,800
Charlestown	31,663	3,900	21,500	1,900	2,500
City Proper, South End and Back Bay.....	151,818	16,300	132,400	24,700	15,400
Roxbury and part West Roxbury.....	92,027	22,100	63,100	4,000	14,000
Dorchester	187,103	19,000	8,200
	520,650	70,900	260,900	44,200	36,700

Tabulation of Bids Received for Five-Year Contract

	Brooklyn Ash Removal Co. of Mass.	Coleman Disposal Company	C. & R. Con- struction Company	C. J. Maney Co.	Reynolds Bros. Inc.
1st 6 mos.	\$ 395,000	\$ 395,400	\$ 450,000	\$ 433,000	\$ 475,000
Next year	415,000	395,400	400,000	433,000	475,000
" "	415,000	395,400	400,000	433,000	475,000
" "	415,000	395,400	400,000	433,000	475,000
" "	415,000	395,400	400,000	433,000	475,000
Last 6 mos.	195,000	395,400	450,000	433,000	475,000
	\$2,250,000	\$2,372,400	\$2,500,000	\$2,598,000	\$2,850,000

Tabulation of Bids Received for Ten-Year Contract

	Brooklyn Ash Removal Co. of Mass.	C. & R. Con- struction Company	Coleman Disposal Company	C. J. Maney Co.	Reynolds Bros. Inc.
1st 6 mos.	\$ 360,000	\$ 412,000	\$ 390,900	\$ 433,000	\$ 465,000
Next year	400,000	370,000	390,900	433,000	465,000
" "	400,000	370,000	390,900	433,000	465,000
" "	400,000	370,000	390,900	433,000	465,000
" "	360,000	370,000	390,900	433,000	465,000
" "	360,000	370,000	390,900	433,000	465,000
" "	360,000	370,000	390,900	433,000	465,000
" "	320,000	370,000	390,900	433,000	465,000
" "	320,000	370,000	390,900	433,000	465,000
" "	320,000	370,000	390,900	433,000	465,000
Last 6 mos.	180,000	412,000	390,900	433,000	465,000
	\$3,780,000	\$4,154,000	\$4,299,900	\$4,763,000	\$5,115,000

Water Department Finances

A business as large as the Water Department should have a working capital for easy operation and to care for the constantly shifting status of current assets and liabilities. Several years ago the Board adopted a policy whereby all fixed capital expenditures should be met by bond issues; the capital expenditures to include meters, fire hydrants, pumps, buildings, lands, mains, supply works and all necessary items that can rightfully be charged to capital account. The amortization of these bonds through annual charges to operation to be in lieu of annual depreciation charges.—*From annual report of Board of Water Commissioners of St. Paul, Minn.*

New Sewage Treatment at Dearborn, Mich.

In an article with this title in our November issue, on page 23, occurred four typographical errors which the printer failed to correct before going to press. In the tenth line from the bottom of the first column, the name of the superintendent should have been given as Mark B. Owen. Ten lines above this, before "which" insert the word "of." In the second column, under the sub-head "Previous Experimental Results," 4th line, "5 pt." should be "5 ft." Five lines lower, "22 p.m." should be "220 p.m."

Milk Carries More Disease Than Does Water

Milk is now a more important carrier of diseases than water, according to the Illinois State Board of Health. In Illinois, no less than 17 milk borne epidemics resulted in 288 cases of typhoid fever during the last decade (1920-1929). During the same period 6 water borne outbreaks resulted in 437 cases of typhoid fever. A greater number of cases were involved in the water borne outbreaks because the polluted water was used by a larger number of people than was the contaminated milk. Milk was responsible for the transmission of several outbreaks other than typhoid fever.

In the United States 258 milk borne epidemics caused 10,906 cases of various diseases during the six years of 1924-1929. During the same years there were reported 143 water borne epidemics which involved 5,083 cases of typhoid fever and dysentery. From these statistics it appears that milk is twice as liable as water to become a carrier of disease under present-day conditions. The statistics probably fail to show a considerable number of limited outbreaks resulting from polluted private wells and from milk supplies which reach only a few people.

In a statistical compilation by Wolman and Gorman, 242 water borne outbreaks of typhoid fever and dysentery, involving 93,712 cases, are listed for the United States during the ten years of 1920-1929. Of these epidemics, Illinois was charged with 13 which involved 7,687 cases, 434 of typhoid fever and 7,253 of dysentery.

Four other states, Pennsylvania, Maryland, New York and West Virginia, were charged with a larger number of water-borne epidemics of typhoid fever and dysentery than was Illinois. The 13 Illinois epidemics were, however, responsible for a larger number of cases of dysentery than were the outbreaks in either of the other states named, while only the cases of typhoid fever involved in New York and Pennsylvania exceeded the number in Illinois.

As a carrier of typhoid fever only, contaminated milk was charged with 177 epidemics involving 4,019 cases in the United States during the six years of

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1924-1929. For the same period, water was credited by Wolman and Gorman with carrying the pollution which resulted in 211 outbreaks and 5,073 cases of typhoid fever (exclusive of dysentery). For the water borne statistics, reports were received from all states but one for all of the years. For the milk borne statistics reports were received from only 32, 33 and 45 states respectively for 1924, 1925 and 1926.

These records indicate clearly that milk supplies now are much more apt than water supplies to become the vehicle of epidemic diseases. Milk is apt to carry the infective agents of a greater number of diseases than water. In both cases it is lack of sanitary control which produces the hazard.

Probably less than one per cent of the recorded milk borne epidemics have been credited to pasteurized milk. As the pasteurizing process reaches a greater number of milk supplies, the number and extent of milk borne outbreaks declines.

Over three-fourths of the water borne epidemics of the last decade have resulted from defects in the treatment, storage, and distribution of the water supplies, according to Wolman and Gorman.

The human factor dominates in both cases. It is within reasonable practicability to provide municipal milk and water supplies which are free from dangerous health hazards.

Sanitary Engineering Developments in New York in 1930

The 1930 Annual Report of the New York State Division of Sanitation brings out the striking fact that although many communities were obliged to resort to polluted auxiliary water supplies during the drought last year, not a single outbreak of water-borne disease resulted from their use. This was doubtless due to the prompt reporting by communities of intention to use auxiliary supplies and the installation by the Division of emergency apparatus for the sterilization of the water. The work of supervising public water supplies increased considerably owing to the drought and a total of 579 inspections were made, over 150 more than in 1929.

As a result of stimulating the construction of public sewerage systems and sewage treatment plants, sanitary conditions have improved markedly in a number of communities throughout the State. Sewerage systems were constructed by twelve communities and new sewage treatment plants were completed and placed in operation in eleven communities. This makes a total of about 165 municipal sewage treatment plants in the State and several more are under construction or contemplated.

Definite progress in protecting the purity of the state waterways is indicated by the fact that during the past year sewage treatment plants were under construction at eight state institutions while the legislature has appropriated funds for similar installations at a number of other state institutions. Many serious cases of stream pollution have also been eliminated through close supervision of sewage treatment plants, and cooperation with industrial plants in studying the treatment of wastes.

A total of 121 water supplies used by railroads and 14 utilized by vessels, representing 100 per cent of the supplies in this State used in interstate traffic, were investigated and their sanitary quality certified to the United States Public Health Service.

Several special studies were made during the year.

Outstanding among these was the survey of the milk and cream supply of the State, authorized by the 1930 legislature which included the milk supplies of 199 municipalities in 51 counties, having a total population of 3,096,135. A thorough study was also made of sewerage, sewage and refuse disposal in Nassau and Suffolk counties at the request of a special Sanitary Commission appointed by Governor Roosevelt. —*N. Y. Health News.*

Extensions to the Newton, N. J., Sewage Treatment Plant

(Continued from page 22)

inches long. No sewage odor has been detectable in the vicinity of the tanks or in the spray from the filter nozzles, since construction.

Digestion Tanks—The original tanks have been utilized as digestion tanks. Sludge pumped from the settling tanks is introduced at the end of one tank, displacing liquid at the same end of the adjoining tank. Liquid must travel 166 feet from point of entry to discharge. The larger tank, to which the sludge force main is directed, has a capacity of 2.8 cubic feet per capita and affords sufficient capacity for storage of sludge during the disintegration process. The smaller tank has a capacity of 6,000 cubic feet and will function as a resettling tank for the supernatant liquid, affording a retention period of 15 days. The clarified liquid will be diluted with the final tank effluent in the sand filter dosing tank and applied on the sand beds. Sludge may be withdrawn from either tank and drained or pumped to the sludge bed; or it may be circulated within the larger tank for "seeding," bringing sludge in an advanced stage of digestion into contact with the solids more recently added.

Sludge Drying—It was necessary to construct an entirely new sludge bed, as the existing unit, in addition to being too small, had no salvage value. A site more convenient for sludge removal was selected and a glass-covered bed constructed. The drying area is 42 by 70 feet, designed on the basis of $\frac{1}{2}$ square foot per capita and underdrained with 4-inch open-joint vitrified laterals placed on approximately 9-foot centers. The drainage medium consists of 9 inches of graded gravel and 6 inches of coarse sand. The laterals connect with an 8-inch main drain leading to a small concrete settling basin. At this point, when sludge is being drawn for drying, the liquid draining from the beds will be dosed with hypochlorite solution, and when displaced from the tank will pass to the stream.

Construction—The excavation for the trickling filter was carried to a point slightly below grade with a dipper-type shovel and then brought to grade with a layer of crushed stone and sand. The same method was followed in connection with the settling tank except that sheeting and shoring was required after a depth of six feet had been attained. A stationary concreting plant was set up and a tower and chute utilized for delivery of the concrete to the various units.

The 2800 cubic yards of crushed quartz rock were placed directly in the filter beds by a fleet of nine 2-cubic yard trucks with pneumatic tires. Runways of 3" planking on 8"x10" sills were used to distribute the weight of the loaded trucks over a large area, thus preventing fracture of the stone and under-drainage system. The product delivered by the local quarry is uniform in size and of good clean quality.

The dosing tank or triple-deck unit is entirely of reinforced concrete, while the controller house is of hollow tile, both buildings being stuccoed with calcite, a limestone product. The battered columns and cornice are figured with a black glazed tile design in diamond patterns which is particularly effective. The diagonal lines appear in the sash and door construction as well as in the black wrought iron railings. The exterior lighting fixtures are mounted on, and are miniature reproductions of, the columns, being of bronze construction and finished in a baked black enamel, fitted with frosted glass.

The trickling filter glassover is of the hip and valley construction with central gutter and downspouts and welded truss members. The entire structure is painted with three coats of aluminum paint, as is the superstructure of the sludge beds.

Costs—The subdivision of contract cost of work, performed at the Clinton Street plant is as follows:

Settling tank, complete.....	\$17,387
Control building, with pumps, piping, mechanical equipment, venturi meter, etc..	16,891
Trickling filter, with glass superstructure..	35,278
Dosing tank unit	16,400
Sludge bed	6,141
Roadway and outside pipe lines	4,678
	\$96,775

Personnel—The works were designed by John G. Albertson under the direction of the writer, with supervision of construction by James M. Kingsley. The construction was performed by Merritt-Chapman and Scott Corporation of New York City, represented by Ralph T. Stewart, with the exception of the glass superstructures which were contracted for by Hitchings and Company. The mechanisms of the special grit and screen chamber and of the settling tanks were furnished by the Link Belt Company. The foundation for the sludge bed at the Sparta Street plant was placed by the Gray Construction Company. These improvements were executed for the town of Newton by authorization of its committeemen, W. Clifford Lane, chairman; George O. Eagles; and Joseph Stouder.

Effect of the 1930-'31 Drought Upon Public Water Supplies

(Continued from page 28)

tioned the possibilities of using purified sewage as a source of public water supply in the following words:

"When sewage has been completely treated in a super-activated sludge plant and is then put through the entire gauntlet of water purification, why should it not be used directly for domestic purposes? Why should its reinstated purity be lost by using the water for less noble purpose?"

These unexplained evidences of a severe intestinal irritant in the Ohio river basin cities during the drought make it necessary that we find the answer before the adoption of reclaimed sewage for drinking purposes.

It has been reasonably well proven that too great an organic and putrefactive load of pollution on a raw water supply will bring about conditions which may cause intestinal disturbances among the users of the water, even though the water meets the strict bacteriological qualifications for a safe public water supply.

Other Results: Public water supplies on the coastal



McWANE PIPE at Boulder Dam

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DENVER
226 Con'tl Oil Bldg.
SAN FRANCISCO
111 Sutter St.
PORTLAND, ORE.
611 Spalding Bldg.

rivers in Pennsylvania, Maryland and Virginia were affected by the diffusion of salt water upstream. On the Susquehanna it came up 30 miles and on the Potomac 16 miles. Certain water supplies in Maryland had to be discontinued on account of the salt content. In Pennsylvania the legislature made available \$50,000 for a complete study of this phenomenon, since the salt invasion menaced the public water supplies of Chester and Philadelphia. The salt water invasion had a secondary effect, investigations by the Department of Zoology of the University of Maryland indicating that the high saline content in the Magothy and Severn rivers was responsible for the very extensive fish killings.

Ground water supplies have been lowered throughout the drought area and no recovery has been made to date in 1931. Well and spring supplies will probably fail in sections of all six drought states during 1931, owing to the fact that the water table is several feet lower than at this time in 1930. This condition in West Virginia developed increased mineralization in deep well supplies, and iron particularly is giving much trouble.

In Ohio the threatened lowering of ground water has been responsible for the action of the 1931 legislature in making available \$10,000 to drill and equip 65 safe wells in Southern Ohio to supply farmers and tourists with safe drinking water.

There was no such large increase in typhoid fever in this area in 1930 as was observed in the 1925 dry period. Possibly the wholesale typhoid immunization indulged in because citizens wished protection was one reason. Then, too, State sanitary engineering divisions were unusually active in the field supervising the chlorination of emergency water supplies.

Stream pollution control work and its needs have been emphasized and the program may be expected to go ahead more speedily. Taste and odor control by use of ammonia-chlorine and activated carbon treatments on public water supplies has received a strong stimulus and it appears likely that processes until now considered in the research stage, will move rapidly to the fields of practical application.

The aggregate and final effect of the 1930 drought on public health will probably be beneficial. The general public has received a dramatic portrayal of the worth of safe, palatable, adequate, public water supplies.

The Water Wheel

(Continued from page 42)

effect similar to that noted in the case of painters of luminous watch dials may be caused, bringing on fatal cancer.

Wagner¹² has made a study of the Eijkman method for the detection of fecal bacteria in water, which is so much esteemed by some workers on the continent of Europe, and finds it untrustworthy.

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The buffer capacity of sea water in testing for hydrogen ion concentration, Thompson and Bonnar⁴⁰.

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Volumetric barium chloride method for sulfates, Andrews³⁹.

Volumetric determination of manganese after oxidation by periodate, Willard and Thompson⁴¹.

Miscellaneous

Swimming pool filter plant at Redcar, England⁷⁸.

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New bathhouse and restaurant at beach near Berlin, Wagner⁴.

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66. Scraping and Electrical Recoating of Water Mains, Anon., pp. 435-436.

67. Self-Priming Centrifugal Pump, Anon., pp. 436-437.

68. Friston 50,000 Gallon Water Tower, Anon., p. 438.

69. Water Supply in the Irish Free State, Statistics of Production, Anon., pp. 439-440.

70. Brownhill Green Pumping Station, Coventry Corporation Water Supply, Anon., pp. 441-442.

n71. The Patjal Storage Dam in Java, Anon., p. 445.

Water and Water Engineering, Vol. 33, No. 394 (September 21, 1931.)

72. New Reservoirs at Godalming, Anon., pp. 467-470.

*73. The Field, Scope and Station of Hydrology, Robert E. Horton, pp. 470-476.

74. Industrial Water Purification Plant Installed at Ham Hall Generating Station of the Birmingham Electricity Works, Anon., pp. 477-480.

75. Hydrographical Survey of the River Tees, Anon., pp. 481-482.

76. Asbestos Cement Pipes: The Manufacture of the Everite Pipes for Water Mains, Anon., pp. 484-486.

77. Effect of Dissolved Aluminum Salts on the Softening Power of Base-Exchange Materials, B. A. Adams, pp. 487-488.

78. Swimming Bath Filtration Plant, Anon., pp. 488-489.

79. Propeller Type Water Turbines, C. S. T. Paul, pp. 491-496.

Water and Water Engineering, Vol. 33, No. 395 (October 20, 1931.)

80. Recent Developments in Corrosion Prevention of Ferrous Metals, V. Kendall and F. N. Speller, pp. 515-516.

n81. Lining for Steel Water Tanks, Anon., p. 516.

82. Llanelly Corporation Water Works, Anon., pp. 517-526.

83. Provision and Maintenance of Communication Pipes: Metropolitan Water Board's New Policy, Anon., pp. 529-531.

84. The effect of Dissolved Manganese Salts on the Softening Power of Base-Exchange Minerals, B. A. Adams, pp. 533-535.

(Continued on page 67)

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THE **STRAIGHTLINE** Aerator is the simplest and most efficient of all mechanical aerators. The speed, and consequently the power consumption, may be varied to suit the organic load.

The plant illustrated was designed for a flow of 1.33 M. G. D., and each of the four aeration tanks is 14'-3" wide, 8'-0" deep and 125'-0" long.

The total population served is about 13,000, and this plant carries the full organic load. The B. O. D. of the effluent varies from 10 p.p.m. to 22 p.p.m., depending on the strength and characteristics of the sewage.

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The Water Wheel (Continued from page 63)

- Water Works and Sewerage*, Vol. 78, No. 10 (October, 1931.)
- 85. The Use of Charcoal and Activated Carbon in Water Treatment, John R. Baylis, pp. 287-290.
 - 86. The Use of Powdered Activated Carbon at Norfolk and Newport News, Virginia, R. W. Fitzgerald, pp. 291-292.
 - 87. Tuberculation of Mains as Affected by Bacteria, H. G. Reddick and S. E. Linderman, pp. 293-296.
- Water Works Engineering*, Vol. 84, No. 21 (October 21, 1931.)
- 88. A Reservoir with Unusual Features, Stuart K. Knox, pp. 1483-1484.
 - 89. Meeting a Serious Drought Situation in Elkins, West Virginia, by an Emergency Water Supply, D. M. Tyler, pp. 1485-1486 and 1517.
 - 90. Water Piped from Mainland to Peninsula thru Swamp-land in New Water Supply for St. Petersburg, Charles F. Ruff, pp. 1487-1488 and 1517.
 - 91. Low Turbidity and Color Help in Operation of the Hartford Filtration System, W. A. Genter, pp. 1489-1490, 1506, 1509-1510 and 1513.
- Water Works Engineering* Vol. 84, No. 22 (November 4, 1931.)
- 92. Milwaukee Installs High Pressure Station for Fire Protection, Herbert H. Brown, pp. 1539-1540.
 - 93. Features of Design and Operation of the New Lockport Filtration Plant, J. F. Laboon, pp. 1541-1542 and 1568.
 - 94. Some Recent Decisions of Higher Courts on the Ownership of Water Rights, Leo T. Parker, pp. 1543, 1571-1572.
 - 95. Special Lining of Pipe Insures the Retention of Carrying Capacity of Cast Iron Mains, Alexander Potter, pp. 1545-1546 and 1567.
 - 96. Construction and Operation of an Iron Removal Plant, F. P. Stradling, pp. 1552, 1564.
 - 97. Effect of Elevated Tank on Indianapolis System, W. C. Mabey, p. 1563.

Placing 19-Ton Bridge Girders With 6½-Ton Crane

How to set two 19-ton bridge girders 80 feet long using only his ½-yard Byers crane with 35-ft. boom, avoiding the expense and delay of renting a 20-ton crane, was the problem faced by E. H. Amlin, contractor, of Barberton, Ohio. Finally he devised an arrangement whereby his own crane, rated to lift only 6½-tons, was able successfully to place and set the two heavy girders.

This is the way: Each girder was run to the job on trailers. When blocked up to let the trailers run out from under, the crane lifted the end of the girder nearest the bridge, and rollers were set under it. Next, the crane moved to the other end of the girder, lifted it, and with a push pole shoved it across the river over temporary false work I-beams and timbers to the opposite pier.

The problem of setting the girder required the building of a 30-ft. gin pole or gallows frame on the far pier from which was rigged four runs of line to the end of the girder beneath it. One end of this cable was run back across the river directly to the crane's closing drum, much in the same fashion that a

dragline cable is reeved. The crane's holding drum held the cable that went over the top of the boom and down through 3 runs of line to the near end of the girder.

Both ends of the girder were placed over the rocker bearings, by operating both cables at the same time. The same cable reeving was used to set the second piece and the total time consumed in distributing and placing these girders did not exceed two ordinary working days.

Street Lighting in Oakland's Central Business District

(Continued from page 26)

number of the standards are erected over sidewalk basements, in which cases the foundations are of special design to suit the conditions.

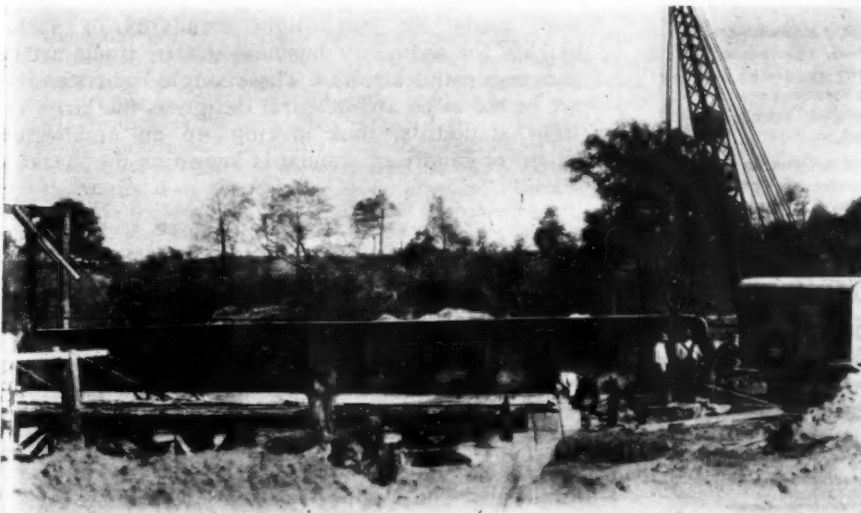
So far as practicable, the standards are spaced a little over 100 feet apart and opposite; except that in a few blocks on three of the narrower streets they are spaced from about 125 to 135 feet apart and staggered, and the spacing is approximately 80 feet at some intersections on account of the length of the blocks.

Each standard is equipped with two General Electric Form 12 Novalux lighting units, with No. 118 medium alabaster rippled glass globes and No. 1118 canopies of the same glass; two 15,000-lumen, 20-ampere, so-called street series lamps; and two series transformers (one for each of the two lamps), 6.6 amperes primary, 20 amperes secondary, installed in the bases of the standards.

The series system of distribution is used and, so far as practicable, each circuit is loaded to approximately 30 k. w. The cable is single conductor, insulated with 30 per cent Hevea rubber compound 3-16 inch thick, covered with plain lead sheath 1-16 inch thick. The cable is connected to the primary terminals of the series transformers with wiped joints.

The circuits are so arranged and controlled that three-fourths of the lamps may be cut out at midnight, leaving the lamp on the curb side of every alternate standard on each side of the street burning the latter half of the night. The lamps burning after midnight are staggered and provide ample illumination for the traffic and other conditions then existing.

Right: A close-up of one of the rippled glass globes. Further details of this set-up are given on page 68. Below: Setting a 19-ton girder with a 6½-ton crane.



ASPHALT PLANTS PORTABLE, STATIONARY, RAILROAD, SAND DRYERS

Either Direct Heat or Internal Flame

The
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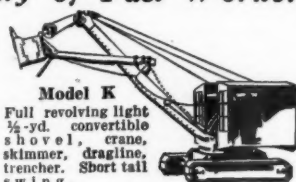
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The connections between the secondary terminals of the series transformers and the lamp sockets are made with No. 8 A. W. G. solid copper wire, insulated with 30 per cent Hevea rubber compound, and covered with two saturated cotton braids. Solid wire was used for this purpose in preference to the more commonly used standard wire in order to avoid the creepage of water down through the interstices of the stranded wire and into the windings of the transformers. Connection to the secondary terminals of the series transformers is made through an angle fitting screwed on to the nipple and filled with insulating compound, a drip loop being provided in the wires outside of the fitting.

The conduit in which the cable is installed is 1½-inch standard-weight black wrought-steel pipe, except that 2-inch is used in a few unusually long or difficult runs. The conduit ends in the base of each standard are fitted with Groundulet conduit bushings with grounding lugs or ears on the side thereof, and the conduits are bonded together through these bushings and stranded copper wire. The cable sheaths are bonded and grounded at suitable intervals. Each lighting standard is grounded to the conduit.

The system was installed upon petition of the owners of a majority of the property frontage on the streets involved, and the cost was assessed against the property, United States and city property being assessed as if privately owned and the assessments paid by the city of Oakland.

Throughout most of the district, the cost to the property owners was from \$4.32 to \$4.64 per front foot, including incidental expenses such as engineering, inspection, publication of official notices, etc. The total cost of the system, including incidental expenses, was \$269,993.27. This is an unusually low figure for an installation of this kind, which no doubt resulted largely from the fact that practically everything required in the contracts was open to competition except the lighting units or tops, which were specified by name and catalog number but represent a very small percentage of the total cost.

The cost of lighting and maintaining the 690 standards, including the underground circuits, is approximately \$69,603 per annum, including an allowance of approximately \$921 for making the assessment and diagram and other incidental expenses of the assessment proceedings. As in other lighting assessment districts, 55 per cent of this cost is assessed against the property, this ranging from approximately 51 cents to approximately 63 cents per front foot per annum. The city pays the remaining 45 per cent, the assessments against United States and city property, and the cost of replacing wrecked standards in case it is impossible to collect from the party responsible for the damage.

In addition to the two-light standards, designs were made for single-light standards of various heights for secondary business streets, traffic arteries and residential streets. These single-light standards are of the same architectural design as the large two-light standards, thus making up an architectural group or family of standards known as the "Oakland Family."

The system was installed in three sections under three separate general contracts, the general contractors being A. C. Rice of Oakland, The NePage-McKinney Co. of San Francisco and the Butte Electric and Manufacturing Company of San Francisco. The lighting standards were made in Oakland, part by the Best Steel Casting Company and part by the Morel Foundry Company. The cable was supplied by the Standard Underground Cable Company. The system is supplied with electrical energy and maintained by The Pacific Gas and Electric Co.

Sewer Construction Through Embankment and Soft Ground

(Continued from page 25)

pipes came together perfectly on the pre-determined line and grade. No difficulty whatever was encountered in keeping the pipe to true line and grade through the hard clay.

From our experience and the experience of others, it would appear that no difficulty should be encountered in jacking any reasonable sized pipe to true line and grade except in fine, dry material or excessively wet material. Fine, dry material or wet material flowing into the corrugations around the pipe as it is jacked forward is bound to cause trouble.

Liability of Surety Companies for Depreciation

(Continued from page 32)

was not the subject of contract between plaintiff (the seller) and defendants (the principal contractor and the surety company), nor did depreciation in any way enter into the terms of the bond."

U. S. Fidelity & Guarantee Co. vs. Yazoo Co. (1926) 145 Miss., 378, 387:

"If the surety should be held to be liable for the plant or equipment of the contractor because the same is worn out or rendered valueless on the work, then it necessarily follows that the surety must be held liable for the depreciation in the value of the machinery and equipment which is caused by its use on the work, for, to the extent of the depreciation caused by such use, the equipment has been consumed in that work. In such a case the court would be required to determine, as the court below did in the case at bar, the value of such equipment when the work was finished and the amount of depreciation in such equipment caused by the use on the particular work. We do not think such is the intention or meaning of the statute requiring this bond."

How Another Community Plans for Unemployment Relief

Public Works:

I notice in the November issue of PUBLIC WORKS an article headed "How One Community Plans for Unemployment Relief." Every city has many such things which can be done to give employment to all worthy unemployed so that no dole will have to be started in this country. A little thought in planning by the engineers and others in charge will provide enough work in most cases which will give full value for every dollar spent.

To care for the unemployment which is facing us, on October 28th I suggested to the City Commission the following needed work. Our trees overhang the streets so that they seriously interfere with the street lights. By extending the sewers, we could greatly increase the amount of water entering the new Carnall Avenue sewer. We have many parkings which have built up above the surface of the walk so that it is necessary to walk through the water during rains. These parkings should be cut and the dirt hauled to places where we want to construct sidewalks. Many of our street corners are very dangerous, particularly to the fire fighting apparatus. Trees have tilted many of our sidewalks until some of them are dangerous to walk over, even in the daytime. Many of the gutters are in such condition that they cut automobile tires when a car is forced off the pavement into the broken gutters. If the city does not feel able to do all this gutter work, the property owners in many cases would probably be willing to pay for the material. Many plumbers' ditches in pavement have settled and should be raised. North "P" Street west of May Avenue should be graded so as to keep the water off the lots of people living along it. Deeds have been given for an extension of South Greenwood Avenue from the Southeast corner of Hillcrest, south and east to a connection with Greenwood Road, and a connection from this road to Jenny Lind Road. These streets should be graded. The flooding of the colored cemetery can be reduced by lowering the grade of Pelley Avenue and South 31st Street, thus providing dirt to raise several hundred graves three or four feet. Now would be an excellent time for some of our rough brick streets to be covered with asphalt. If the property owners would furnish

the material they would get the cheapest possible pavement. Developments in the last twenty years have made many blocks of pavement dangerously narrow, such as North Fifteenth Street from "B" to "C," South Thirteenth Street from "A" to "B" and others. In such places the property owners might be glad to furnish the material and the city furnish the labor. Many alley returns might be paved by the same agreement. Following is a list of these items, with an approximate percent of the cost to the city which would go to Fort Smith labor.

Trim trees	90%
Extend sewers	75%
Cut parkings	85%
Round corners and pave with brick.....	70%
Level walks	98%
Repair gutters, owner paying for material.....	95%
Raise ditches in pavement.....	98%
Grade N. "P" Street, west of May Avenue.....	85%
Grade S. Greenwood.....	85%
Lower Pelley and S. 31st Street.....	85%
Asphalt pavement, property owners furnishing material	80%
Pave alley returns, property owners furnishing material	95%
Widen pavement, property owners furnishing material	95%

H. S. PECK,

City Engineer, Fort Smith, Ark.

Organization of the Division of Sewers and Paving, St. Louis

(Continued from page 23)

charge of this section is assisted by district engineers who directly supervise and have charge of the engineering, surveying and inspection necessary in the sewer projects carried out in their districts. These district engineers, in the case of large projects such as the River Des Peres sections or large relief sewer systems constructed in either tunnel or open-cut, become resident engineers on these projects. Generally a construction survey party, consisting of a surveyor, instrumentman and two rodmen, is assigned to each district engineer.

For the past several years, the sewer construction section has had four district engineers supervising all new sewer construction carried out in St. Louis.

Six—Paving Design Section. This section prepares "hearing" estimates and, on receiving improvement plans prepared from survey notes by the Drafting Section, prepares an estimate of the work involved for each street or alley, designs curb grades and locations, cross-sections of roadway, etc., based on the type of pavement designated by the board, and itemizes work for letting contracts. At the completion of each contract it prepares the final estimate.

The number of employees in the Paving Design Section in recent years has been from 12 to 14 engineers and estimators headed by an engineer in charge of paving design. All drafting of the final plans as designed by this section is carried out by the Drafting Section.

Seven—Paving Construction Section. This section is by far the largest in numbers of any in the Division. It is headed by an engineer in charge of construction, assisted by district engineers who supervise the paving projects carried out in their district, by a concrete engineering and inspection sub-section, and by a bituminous pavement engineering and inspection sub-section. Each district engineer has at least one construction survey party assigned to his district; in recent years, in a number of instances, two survey parties have been necessary in some districts where the volume of work has been large.

The construction is inspected by inspectors of construction assigned to the project, and in addition inspectors are stationed at central concrete plants where wet-mix concrete is used, or at material yards

PITTSBURGH

DES MOINES



End and side views of National Highway Bridge over Monocacy River near Dickerson, Maryland, U. S. A., fabricated and erected by "Pittsburgh-Des Moines" in the summer of 1931. It consists of three high truss duplicate spans each 145 feet long with a 27 foot concrete floor roadway.

Good Transportation Demands Good Bridges

Well-constructed bridges of good engineering design are absolutely essential to any program of national highways improvement.

Skilled workmen in a modern plant fabricate accurately the structural members for a "Pittsburgh-Des Moines" bridge. Our engineers have had a long and successful experience in designing bridges for highways, waterways and railways. After designing, manufacture and shipment of material to location, "Pittsburgh-Des Moines" erection crews will complete the structure in quick time.

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where dry batches are prepared and hauled to the mixer on the site of the work. On bituminous paving, inspectors are present at the plant whenever any mixture is being prepared. The specifications provide that no work can be carried out without inspection. The number of inspectors, exclusive of bituminous inspectors, in recent years has been between 40 and 50, in addition to 15 inspectors assigned to the plant and on the street for bituminous pavements.

For the last five years, a concrete engineering and inspection section has been maintained under the supervision of the engineer in charge of paving construction. Two engineers have been assigned to this work to supervise directly the concrete mixing, to whom the inspectors on concrete work report for instructions.

The maximum number of employees in the organization of the division has been 275. This number was employed during the year 1928 when over 57 miles of street paving and 29 miles of alley paving was carried out at a cost of \$5,517,000. The cost of sewer work completed during that year totalled \$2,814,000. At the present time our organization numbers 214, which is considerably in excess of the number necessary for the volume of work to be carried out this year. A large turn over in the personnel of an organization such as this, being mostly technical, is very costly and results in marked inefficiency, and this organization was carried through the winter in the hope that a large amount of work would be done this year. However, the city officials have been persuaded against this by the tax payers and this year's program is the smallest for ten years past.

Low Labor Turnover in Automobile Industry

According to the U. S. Department of Labor, the labor turnover for 75 selected industries in 1930 was 27.6%, but that for the automobile industry was only 1.56%. Even better was the showing made by the F W D plant—only 0.712%. This is, the company claims, due to conditions under which the men work. The company reports: "99.6% of our employees are Americans; 85% own automobiles; 95% have electric light and power appliances in their homes; 100% work for a definite hourly or monthly rate—no piece or premium work; 100% are white; 47% are high school and college graduates.

Mikey & Ikey

(Continued from page 17)

Solving equations (1) and (2)
x equals 44.7368 + years or Ike's age
y equals 55.2631 + years or Mike's age.

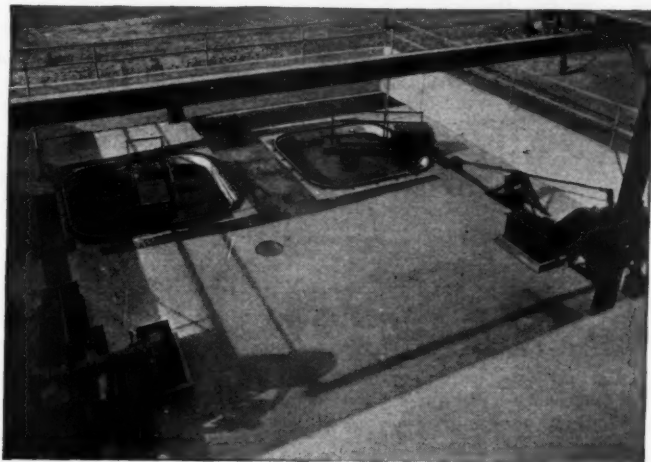
Most of the solutions gave the answer in fractions. For Ike, 44 14/19 and for Mike, 55 and 5/19.

Mr. Reichstein deserves double credit. His was the fifth solution received (the third and fourth were incorrect), and he then followed this up by sending in a solution employing only one variable. He says (and probably a good many sympathize with him): "I hope the next problem doesn't include Ikey and Mikey, as I got dizzy trying to tell whether I was working on Mikey or Ikey."

Mr. Gilbert, who slipped into fifth place by using special delivery stamps, employed 3 variables. D. Y. McDowell, superintendent of waterworks, Malvern, Ark., who, unfortunately came in too late for credit, figures out the ages of Ike and Mike correctly, but says: "It will be difficult to determine Jerry's age until he has walked the floor with his new daughter a few months—and then he'll look older than he really is." Check, and double check! H. Gerald Bobst of Garden City, Kansas, wants to know if it is a workable problem or just a joke; but he sent in a correct solution—just too late.

Two Dorr Detritors

removing grit from the sewage at Greensboro, N. C.



Grit removal in the new sewage treatment plant at Greensboro, N. C., is continuous and automatic. Two Dorr Detritors are performing this operation and they are doing a job that could not be duplicated by plain grit chambers. Dorr Detritors are removing the grit continuously, which, of course, plain grit chambers could not do. Plain grit chambers have to be cleaned out by hand or by hand-controlled machines; Dorr Detritors are automatic. Dorr Detritors wash the grit before discharge; plain grit chambers do not. The grit discharged from the Detritors can be used on roadways or as fill; grit removed from plain grit chambers carries considerable organics and is often offensive and odorous.

Mechanically, the Dorr Detritor is simple. There are no submerged bearings in contact with the grit. All parts are slow-moving. Power costs are low.

Get the story of the work that Detritors are doing in sewage treatment plants in North America and Europe. Just drop a line to our nearest office.

BULLETIN 6481



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TOKYO: Andrews & George Co., Inc.

JOHANNESBURG: Edward L. Bateman, Pty., Ltd.

New Equipment Developments

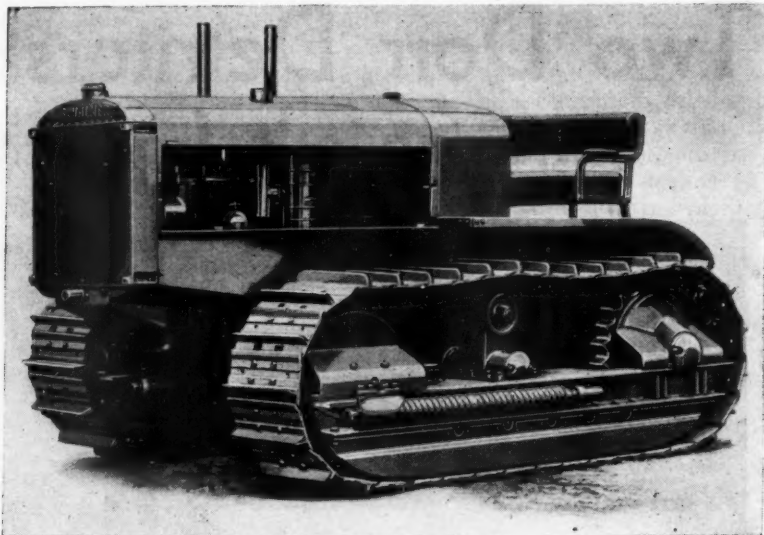
Allis-Chalmers Announces a New Track-Type Tractor

The Allis-Chalmers Manufacturing Company of Milwaukee, Wisconsin, announce their new Model "L," a six-cylinder track-type tractor, built to meet the modern demand for a powerful, fast, heavy duty, easily handled machine.

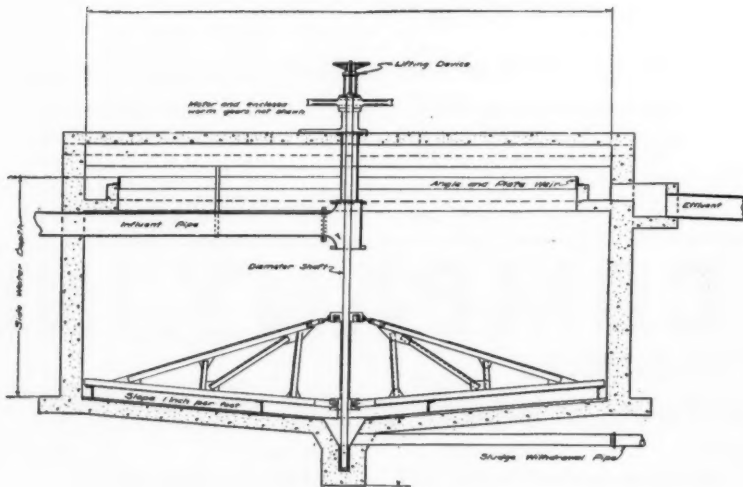
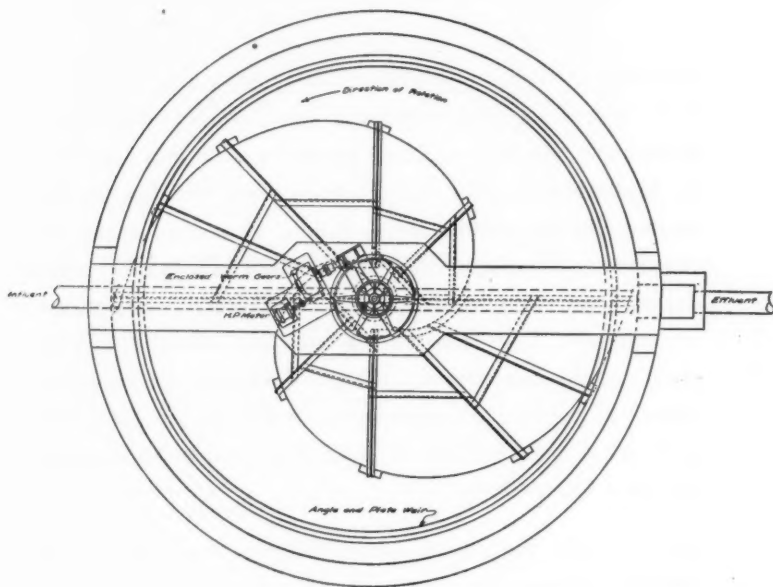
The Model "L" has six forward speeds ranging from two to 6½-miles per hour; force feed lubrication; oil,

air and fuel filters; removable cylinder sleeves; and many other outstanding features. It has low center of gravity combined with high road clearance, and

will handle the largest elevating graders in all workable conditions of road and soil, as well as the largest snow plow in heavy drifts.



The new Allis-Chalmers Model "L" 6-cylinder track type tractor



Simplex Sludge Concentrator

Simplex Spiral Sludge Concentrator

The Simplex mechanism for sludge concentration is shown in the accompanying drawing. The arms are equipped with spiral scraper mechanisms so arranged as to be revolved slowly by a central vertical shaft, thus sweeping solids deposited on the floor of the tank to a discharge outlet at the center.

The concentrator is operated by a motor, which is connected through a flexible coupling to a speed reducer. Provision is made for raising the main shaft, arms and scraper as a unit, without disturbing the operation.

This equipment is manufactured by the Simplex Ejector and Aerator Corporation, 2528 Madison St., Chicago, Ill.

Meyer Auto Snow Plow

The Shunk Mfg. Co., Bucyrus, O., has taken over the manufacture and sale of the Meyer auto snow plow, formerly made by the Empire Plow Co. Many of the uses of this snow plow were outlined and a description of its technical features given in the October, 1931, issue (p. 38).



The Meyer Auto Snow Plow

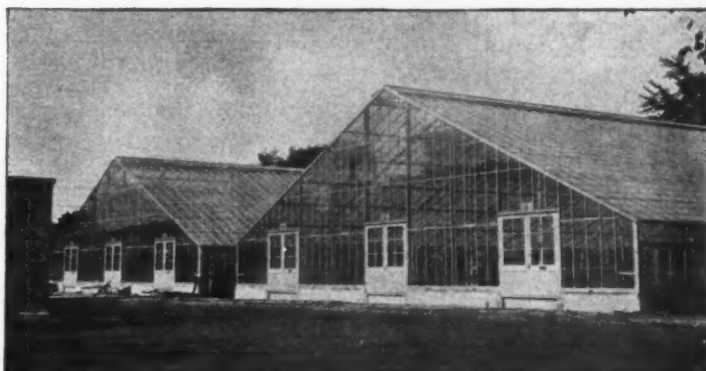
The City Engineer of Ithaca, N. Y. Took This Snap-Shot, Himself

Such satisfaction does H. W. Eustice, City Engineer of Ithaca, take in the SUPER-FRAME Glass Covers over the sewage treatment plant there, that he took this picture of them, himself.

But the enthusiasm as evidenced by this action does not stop with Mr. Eustice, alone.

Glenn D. Holms, Consulting Engineer, puts his O. K. on them as follows: "I was particularly pleased with the excellent workmanship shown in all details. . . ."

For further evidence we refer you to these engineers, themselves, or suggest that you inspect a SUPER-FRAME Glass Cover and see for yourself.



WE INVITE members of the Sewage Committee and Engineers to use the services of our experienced engineers and call on us for plans and specifications on covers for proposed or existing sludge beds and spray houses.

SEND FOR our engineers folder which gives typical plans and specifications for SUPER-FRAME glass covers.

HAVE THE FACTS BEFORE YOU.

Hitchings and Company

General Offices and Factory: Elizabeth, N. J.

EXXLCELL Sewer Pipe JOINT COMPOUND

Not one pound ever rejected!

PREPARED from carefully selected asphalts and acid-proof fillers, compounded and manufactured to rigid specifications, ExXLcell Sewer Pipe Joint Compound insures permanent water-tight, acid-proof joints.

ExXLcell melts freely, cools rapidly and sets in a few minutes after the joint is sealed. Two or three joints may be

poured outside and lowered into the trench as a unit thereby reducing labor in the restricted space of the trench.

ExXLcell is pliable at all temperatures. It will not run in summer or crack in winter. Strong acids and alkalis in the sewage have no effect on it. ExXLcell is sure and trouble-free. It saves time and labor. Use it on your next job.

1. WATER-TIGHT
2. ROOT-TIGHT
3. ACID-PROOF
4. INDESTRUCTIBLE
5. LOW LABOR COST
6. FLEXIBLE

Cochrane Chemical Company

*Industrial Paints, Waterproofing and Insulating Compounds,
Expansion Joint Compounds, Cements.*

432 Danforth Ave.

Jersey City, N. J.

News and Items From the Field

I. R. Riker has resigned as senior sanitary engineer of the New Jersey State Department of Health, after 16 years service, and is now connected with the Borough of Princeton, N. J., as personal representative and resident engineer on their new sewage treatment plant and trunk sewer.

Dr. Edward R. Weidlein, Director, Mellon Institute of Industrial Research, Pittsburgh, Pa., has announced the foundation of an Industrial Fellowship by the Green Bag Cement Company of Pittsburgh, subsidiary of the Davison Coke and Iron Company. The investigational work of this Fellowship, which will be carried on by Raymond C. Briant, will be concerned with studies of the chemical and physical properties of portland cement and with the development of certain new cement products.

Heltzel Steel Form & Iron Co., Warren, O., has completed the installation of additional machinery and equipment in their recently completed addition.

A. W. Thompson, who for the past five years has been Pacific Coast Manager in charge of sales for Fairbanks, Morse & Co., has been appointed vice-president in charge of manufacturing.

The Continental Motors Corporation has announced the concentration of its motor manufacturing operations in Muskegon. The Detroit plant will not be abandoned, rented or sold, but will be utilized for other purposes.

The Board of Directors of Worthington Pump and Machinery Corporation has announced the election of LaMonte J. Belnap as chairman of the executive committee of that corporation. Mr. Belnap is succeeded as president by Harry C. Beaver, formerly vice president.

Jack Conway has been appointed Sales Manager of the H. O. Penn Machinery Company, New York City, with headquarters at the main office of the company, Port Terminal, 140th Street and East River. He will be in charge of sales of the entire line of construction and industrial equipment.

The Hall-Perry Machinery Company of Butte, Montana, has recently been appointed as agent for Gardner-Denver Rock Drills and Portable Compressors. The appointment was effective immediately and the Hall-Perry Machinery Company is now actively representing the Gardner-Denver Company.

Littleford Bros., Cincinnati, Ohio, manufacturers of road maintenance equipment, have opened a Chicago office. Herbert M. Orschel, formerly with the Mohawk Asphalt Heater Co. and the Aeroil Burner Co., is in charge. The new address is Littleford Bros., H. M. Orschel, Dist. Mgr., 217 E. Illinois St., Chicago, Telephone, Superior 9613.

Chicago Pneumatic Tool Company announces the removal of their office and service station at Seattle, Wash., from 1743 First Avenue South to 3201 First Avenue South and the appointment of C. Kirk Hillman as District Manager.

B. T. Ehrnman, who was formerly located in the Chicago office of the International-Stacey Corporation, has been transferred to St. Louis as Division Manager, with offices at Room 2192 Railway Exchange Building. Mr. Ehrnman has been associated for a number of years with the Roots-Connersville-Wilbraham Division of this company in the sale of gas pumps, meters, blowers and other equipment. With the opening of the St. Louis office he will also have charge of the sale of Ideco Oil and Gas Drilling and Pumping equipment, Stacey Brothers Telescopic, Bullet Pressure and Stacey-Klonne Dry Seal Gas Holders, Ideco Standard Steel Buildings, Ideco Airport and Airway equipment and Ideco Electrical equipment in addition to the Roots-Connersville-Wilbraham line of products.

F. D. Hooper, formerly sales manager of the Lidgerwood Manufacturing Company, Elizabeth, N. J., has been appointed general sales manager of the Barber-Greene Company, Aurora, Ill., manufacturers of material handling equipment. He has been with the Lidgerwood company for twenty-four years.

The Gardner-Denver Company has completed arrangements with the Interstate Machinery & Supply Company of Omaha, Neb., whereby the latter has an agency in Omaha and vicinity for Gardner-Denver products. Included in the products distributed by the Interstate Machinery & Supply Co. are Gardner-Denver horizontal and vertical compressors; steam and power pumps; portable compressors; rock drills and accessories.

C. B. Coldwell, formerly located in Chicago, has been transferred to the Ft. Worth office of the International-Stacey Corporation. He has been placed in charge of the sales of the Roots-Connersville-Wilbraham Division line of R-C-W rotary positive blowers, meters, gas pumps and exhausters, Hayton centrifugal pumps and blowers and the Stacey Bros. Gas Construction Division's Telescopic and Stacey-Klonne dry seal low pressure gas holders and Stacey "Bullet" high pressure gas holders. The International-Stacey Corporation offices are located at 1309 Aviation Building, Ft. Worth, Texas.

W. W. Sebald, Vice President in charge of distribution for The American Rolling Mill Company, has announced the appointment of R. C. Todd as Assistant Vice President of the Company. Todd formerly was assistant general sales manager. His new duties will involve special work in connection with the company's sales activities. Mr. Sebald also announced that H. M.

Richards, manager of Armco's Cleveland sales district, had been appointed assistant general manager of sales. He will return to the home offices in Middletown as soon as his successor can familiarize himself with the work of the district. Foster E. Wortley has been appointed Richards' successor as Armco's Cleveland district manager. He is at present assistant district manager of the Pittsburgh office, and has been connected with the sales division of the company since 1912. O. L. Conley has been appointed assistant manager of the Cleveland district.

The merger of the George W. Moore Company, of Chicago, with H. W. Caldwell & Son Company, a subsidiary of Link-Belt Company, is announced by Alfred Kauffmann, President, Link-Belt Company. The combined units are to be known as The Caldwell-Moore Division, Link-Belt Company. Max H. Hurd, formerly President of the George W. Moore Company, becomes a Vice President of Link-Belt Company, in charge of the Caldwell-Moore operations. His headquarters will be at 2410 W. 18th Street, Chicago.

Ralph Leavenworth has been appointed general advertising manager of the Westinghouse Electric and Manufacturing Company. He will have charge of all advertising and publicity activities of the company, the announcement reads, including the advertising division of the merchandising department, now centered in Mansfield, Ohio.

The Beckwith Machinery Company at Pittsburgh has recently contracted to handle the complete line of Byers' shovels and cranes in sizes from 1¼ cu. yd. to ¾ cu. yd. manufactured by the Byers Machine Company, Ravenna, Ohio. Their territory will include western Pennsylvania, southeastern Ohio and counties in West Virginia within 100 miles of Pittsburgh.

An order for one and a half miles of belt conveyors has been received by the Stearns Conveyor Company of Cleveland, a subsidiary of the Chain Belt Company, Milwaukee, for construction work on the Hoover dam. The order consists of approximately 1,200 Troughing and Return idlers. These idlers will be of the Rex-Stearns unit casting closed-head type, especially designed for the severe handling service represented by the rock and gravel industry. Thirty-inch belts and smaller will be built in the 3-pulley type of construction and 36 inch and 42 inch sizes will be furnish in the 5-pulley type of construction. The gravel plant at Hoover dam, which is to prepare the aggregates for later construction, will be located at Boulder City, Nevada, and will, during the course of the construction work on the dam, handle approximately eight million tons of sand and gravel. Rex-Stearns rubber-covered idlers will be used at the loading points to reduce belt wear to a minimum.

After 102 Years



(Above) Unretouched photograph of 102-year-old cast iron pipe still serving City of Lynchburg, Virginia. (Group—left to right) Mr. John Victor, grandson of John Victor, Esq., who conceived the water works project; Mr. R. W. B. Hart, City Manager; Hon. J. Tanner Kinnier, Mayor; Mr. Richard F. Wagner, Director of Public Safety.

FOUR weeks ago the Water Department of Lynchburg, Virginia, uncovered for inspection a 7-inch cast iron water main that has been in service for over 102 years. It is probably the world's first high pressure waterline installation.

This venerable yet still vigorous cast iron pipe went into service on July 18, 1829, and was used as a pumping main until 1882 when it was replaced by the 12-inch cast iron main shown alongside in the above unretouched photograph. Since that time it has been used as part of the distribution system and has never given any trouble.

After more than a century of continuous service, this historic cast iron main was inspected, found in good condition, the earth thrown back . . . and it continues to serve, for how long no man can say.

Serving today in many of our older

cities are cast iron gas and water mains that were laid 90 to 100 and more years ago. These long-lived cast iron mains are probably the only example of century-old engineering material which is still giving satisfaction under the radically changed conditions of today. Cast iron pipe's long life has saved millions of dollars to taxpayers.

The reason for the long life of cast iron pipe is its effective resistance to rust. Cast iron is the one ferrous metal for water and gas mains, and for sewer construction, that will not disintegrate from rust. This characteristic makes cast iron pipe the most practicable for underground mains since rust will not destroy it.

Every taxpayer should take an active interest in the kind of pipe being laid, or to be laid, in his community. For

further information write to The Cast Iron Pipe Research Association, Thomas F. Wooten, Research Engineer, 122 South Michigan Avenue, Chicago, Ill.

Cast iron pipe bearing the "Q-check" trademark is obtainable from the following leading pipe founders: Alabama Pipe Company, Anniston, Ala.; American Cast Iron Pipe Company, Birmingham, Ala.; James B. Clow & Sons, 219 N. Talman Avenue, Chicago, Ill.; Donaldson Iron Company, Emaus, Pa.; Glamorgan Pipe and Foundry Company, Lynchburg, Va.; Lynchburg Foundry Company, Lynchburg, Va.; National Cast Iron Pipe Company, Birmingham, Ala.; United States Pipe and Foundry Company, Burlington, N. J.; Warren Foundry and Pipe Corporation, 11 Broadway, New York.



Look for the "Q-check" symbol as shown above. It is the registered trademark of The Cast Iron Pipe Research Association.

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CAST IRON PIPE

For latest catalogs—consult the classified INDUSTRIAL LITERATURE section, beginning on page 5

ENGINEERING SOCIETIES

American Road Builders' Association

Advance planning of highway and paving activities, with the attendant stabilization of highway activities, while providing unemployment relief, will be one of the principal matters before the American Road Builders' Association, which will hold its 29th annual convention at Detroit, during the week of January 11-15, 1932.

The Road Show will be held at the Municipal Airport building, which is 1,000 feet long and 200 feet wide. More than 40 technical meetings, holding interest for the various groups attending the convention, will be held.

Nominees for officers of the American Road Builders' Association are for president, T. H. Cutler, chief engineer, Missouri Highway Commission, Jefferson City, Mo.; vice-presidents: E. L. Benedict, vice-president, National Steel Fabric Co., Pittsburgh, Pa.; J. W. Barnett, chairman, Georgia Highway Department, Atlanta, Ga.; G. C. Dillman, state highway commissioner, Lansing, Mich.; Stanley Abel, supervisor, Kern county, Cal. There were also nominated seven new directors of the association. For president of the city officials' division is nominated R. B. Brooks, director of streets and sewers, St. Louis, Mo., and for president of the county highway officials' division W. O. Washington, county engineer, Cameron county, Texas.

The Missouri Water and Sewerage Conference

The Seventh Annual Meeting of the Missouri Water and Sewerage Conference, held in Jefferson City on October 22 and 23, 1931, provided an unusually attractive program consisting of papers and discussions on subjects of interest to water works and sewage treatment to plant superintendents. Eighty-two men registered before the close of the conference.

Papers and discussions relating to water treatment were given by the following persons: William J. Gray, Consulting Engineer, Springfield; W. B. Rollins, Consulting Engineer, Kansas City; Judge Milton R. Stahl, Chairman, Missouri Public Service Commission; L. O. Williams, Jr., District Public Health Engineer, El Dorado Springs; A. G. Fiedler, U. S. Geological Survey, Washington, D. C.; Dr. H. A. Buehler, State Geologist, Rolla; H. S. Hutton, Wallace & Tiernan Company, Newark, N. J.; Herbert Bosch, State Board of Health; W. Scott Johnson, State Board of Health, and E. E. Wolfe, Hannibal.

Papers on sewage treatment were given by G. R. Scott, of Black & Veatch, Consulting Engineers, Kansas City, Mo.; R. E. McDonnell, of Burns & McDonnell, Engineering Co., Kansas City, Mo.; Geo. S. Russell, of Russell

& Axon, Consulting Engineers, St. Louis, and H. C. Delzell, of the Portland Cement Association, Chicago, Ill.

At the business meeting the following officers were elected for the ensuing year: Chairman, E. E. Wolfe, City Chemist, Hannibal; Vice-Chairman, W. E. Barnes, Supt. Water Works, Liberty; Secretary-Treasurer, Herbert Bosch, Assistant Public Health Engineer, State Board of Health, Jefferson City. Executive Committee: A. V. Graf, Chief Chemical Engineer, St. Louis Water Department, St. Louis; L. W. Helmreich, Manager, Capital City Water Co., Jefferson City; M. S. Hogan, Supt. Water Works, West Plains, Mo.; A. E. Thain, Supt. Water Works, Neosho.

National Paving Brick Association

The twenty-sixth Annual Meeting of the National Paving Brick Association will be held at Chicago, Ill., February 10-11-12, 1932. The program for the last two days will include papers and discussions of the latest practices in the design and construction of streets and highways, particularly the vitrified brick type. These sessions will be open to the general public and any one interested in street and highway development is invited to attend.

The program, now under preparation, will be presented by prominent engineers, contractors and paving authorities. It will include descriptions of recently constructed brick highways, streets and boulevards; efficient management of brick paving contracts; and discussions of the application of highway research to modern brick pavement design, including filler and cushion construction. The use of brick for resurfacing and replacement work will be featured. One session will be devoted to a field inspection of one of the recently completed brick resurfacing improvements near Chicago.

The annual banquet will be held Thursday night, February 11, and business conferences will be held on the first day of the meeting.

George F. Schlesinger, formerly State Highway Director of Ohio, is Chief Engineer and Managing Director of the National Paving Brick Association.

Iowa Sewage Treatment Conference

The thirteenth annual Iowa Sewage Treatment Conference, and the fifth annual meeting of the Iowa Wastes Disposal were held at Iowa State College, Ames, Nov. 18-20. A number of excellent papers were presented, and there was considerable discussion on some of them, especially on "How Can Sewage Treatment be Financed?" which was presented by Howard R. Green, president H. R. Green Co., Consulting

Engineers, Cedar Rapids, Iowa. "The Development of Sanitary Engineering in Iowa" by Dean Anson Marston, who designed the first sewage plant in the state and has been in touch with developments for more than 40 years, was a remarkable paper.

Officers were elected as follows: President, Max Levine (succeeding Jack J. Hinman, who has been president for the past two years; vice-president, Prof. Earle L. Waterman; directors, Lafayette Higgins and James A. Nelson; representatives to the Federation of Sewage Works Association, W. E. Galignan and Max Levine.

Highway Research Board

The eleventh annual meeting of the Highway Research Board, National Research Council, will be held on December 10 and 11, 1931, in Washington, D. C. The meetings will be in the Auditorium of the National Academy of Sciences, 2101 Constitution avenue.

The sessions will be devoted to discussions of reports of research activities in relation to Highway Finance, Transportation, Design, Materials and Construction, Maintenance and Traffic.

Association of Highway Officials of North Atlantic States

The eighth annual convention of this association will be held at Atlantic City, N. J., February 17, 18 and 19, 1932.

Recent Catalogs

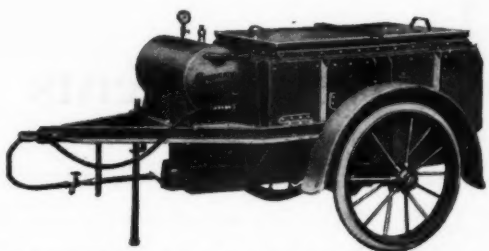
Snow Plows.—Western snow plows are described in Bulletin W-31-K, which has just been issued by the Austin-Western Road Machinery Co., Chicago, Ill. This bulletin illustrates and describes a complete line of snow plows for motor trucks.

Caterpillar Diesel Tractor.—A recent statement has been issued by the Caterpillar Tractor Co., Peoria, Ill., which answers a good many questions and gives a great deal of information about the new Caterpillar diesel tractor. In fact, this statement provides a pretty liberal education on diesel driven tractors.

Power Shovels.—Recently issued by Bucyrus-Erie Company of South Milwaukee, Wisconsin, is a new bulletin on their new 42-B 1½-yard electric shovel-dragline-crane-clamshell. Inside its attractive four-color cover, twenty pages are used to illustrate and describe the new machine. Working ranges and specifications are conveniently arranged for ready reference of the reader.

Crawler Wagons.—A folder issued by Austin-Western Road Machinery Co., Chicago, Ill., describes the new Western 7-8-yard crawler dump wagon with spring windup.

Barnsdall Admix.—The Barnsdall Tripoli Co., St. Louis, Mo., have just published Bulletin E describing the use of their admix as an integral waterproofing for concrete, mortar, stucco and cement products.



We manufacture a full line of Tar and Asphalt Kettles, Oil Burning Kettles, Pouring Pots, Torches, Hand Spraying Attachments, etc. Send for our "Blue Book" illustrating our complete line.

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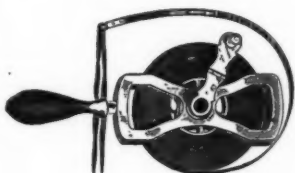
Style "J" Oil Burning Kettle will guard any highway with economy and efficiency. Something easy to handle and quick to heat. Equipped with standard roller bearings, springs, improved oil burner and rubber tired wheels and heat guards if desired. In Connery's Tar and Asphalt Heaters, contractors, town and city officials will find the very highest development of superior workmanship and design. Kettles are made in twenty styles and sizes, in capacities of 10 to 1000 gallons.

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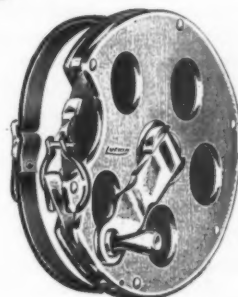
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DETROIT, MICHIGAN, U. S. A.

Pavements cost you less

when rolled with **ERIE**
ROLLERS



You get these features in an ERIE

Instant smooth reversing
Guaranteed high compression
Uniform hardness from curb to curb
Minimum of hand tamping
Better factory service

Greater flexibility for cross rolling
Balanced weight, preventing sinking in or bridging
Clear view for the operator
Unequaled ease in steering

Write for catalog today.

Erie Machine Shops, Erie, Pa.

Roller Specialists for 40 years.

Shovel, Dragline, etc.—Bucyrus-Erie Company has just published a new bulletin on the recently announced 21-B shovel-dragline-clamshell-lifting crane. This 24 page bulletin (8½ x 11) is liberally illustrated with operating and machinery views, and includes specifications and working range diagrams which will be of value. A copy will gladly be furnished any reader who will address his request to Bucyrus-Erie Company, South Milwaukee, Wis.

Autocars for Construction Hauling.—A 50-page illustrated booklet designed to show the variety and importance of Autocar truck use by men engaged in the important business of construction. Interesting views of many recent important projects.

Solution Feed Chlorinator.—The Paradon Company, Arlington, N. J., has recently issued Bulletin No. 28 describing the new Paradon Solution Feed Chlorinator. Some months ago the Paradon Company was successful in obtaining from the owners of the Ornstein Patent a license to sell this type equipment and is now in a position to supply solution feed chlorinators for use in the sanitary and other fields requiring this type of equipment. They will send a copy of this bulletin to anyone requesting it.

Sewage Pumps.—Yeomans Bros. Co., 1433 Dayton St., Chicago, Ill., have just issued a new and complete bulletin, S-6200, which contains much valuable information on sewage pumps.

Spiral Pressure Pipe.—Armco spiral welded pipe for pressure lines is described and design factors discussed in a bulletin recently issued by The American Rolling Mill Co., Middletown, O.

Meters and Their Purpose.—An unusual 68-page book has been published by the Republic Flow Meters Co., Chicago, Ill., "Republic Economy in Industry." It contains much information, valuable alike to industry and to municipality and engineer.

Power Pumps.—Horizontal-duplex-piston pattern; cap and valve plate: type D-2437—for general service; 6-inch stroke, inclosed crankcase, self-oiling. Capacities, sizes and description. Specification Sheet No. D-412-S6, 2 pages. Worthington Pump & Mach. Corp., Harrison, N. J.

Pipe Tools.—The Borden Co., Warren, Ohio, have just issued their new No. 32 catalog of pipe tools, which they say is a "boiled down issue that makes it easy for a man to locate just what he wants." It contains much essential information on the subject.

Glass Enclosures.—The American-Monninger Greenhouse Mfg. Corp., 1947 Flushing Ave., Brooklyn, N. Y., has issued a bulletin describing their glass enclosures for sludge drying beds. Many details of construction are illustrated and specifications for glass enclosures are outlined. This will be sent on request to engineers and officials.

To order any of the above catalogs, use the coupon on Page 5.

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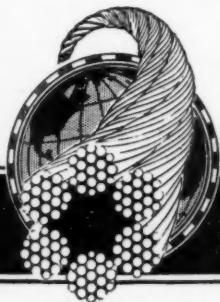


for Long
Enduring
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Williamsport *Wire Rope*

Good engineers know there's a vast difference in various makes of wire rope and the service it renders. . . . The point we wish to leave with you is that our interest in the manufacture of wire rope is not divided. . . . We make wire rope only—nothing else

and that we concentrate our facilities and train our men to perfection in this task. . . . May we send you our latest catalog and data book which tells you a lot more about Williamsport Quality?



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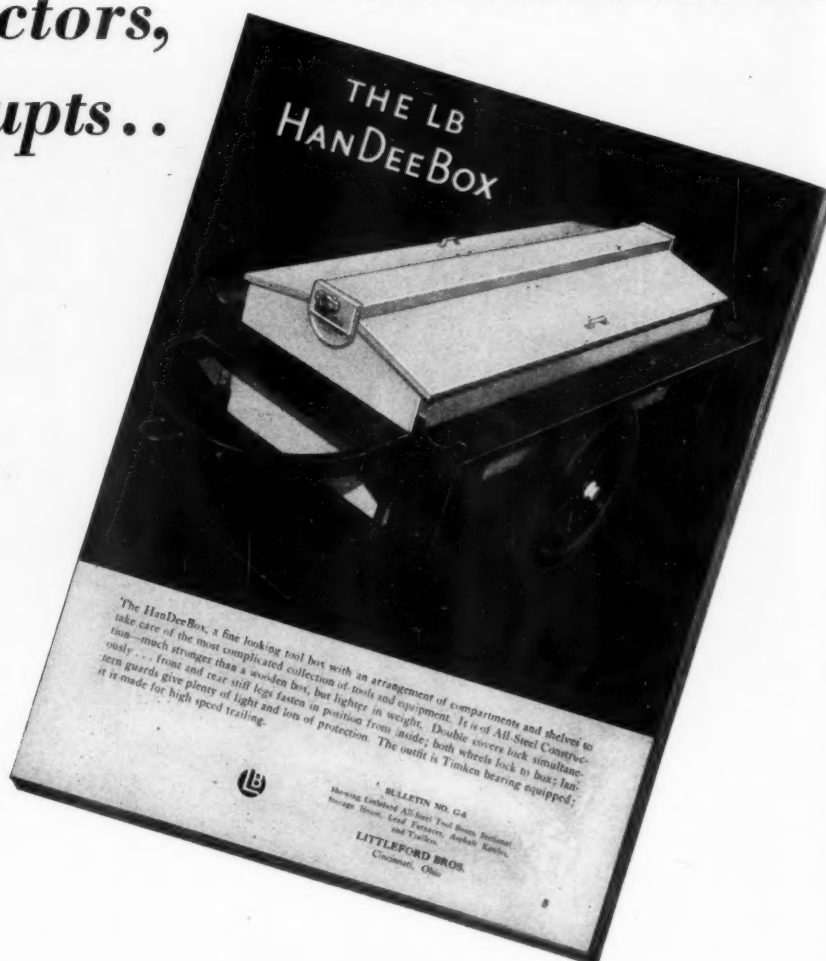
For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 5

Highway Engineers, Paving Contractors, Water Works Supts..

*You should have
a copy of this
Bulletin*

NOTE

This coming January the HanDeeBox will be shown at the American Road Builders Association Road Show at Detroit.



If it is necessary for you to have tools and equipment moved often from one place to another, this bulletin will be of interest to you. It tells about the HanDeeBox, an all-steel tool box that possesses many advantages. Send the coupon, today. Bulletin No. G-6 will be forwarded without any obligation to you.



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Road Maintenance Equipment

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Cincinnati, Ohio.

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ALUMINUM SULPHATE FILTER ALUM

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Not the least of the advantages of making this Company your source of supply, is that of knowing that your delivery schedule can be maintained—regardless of circumstances. Address your inquiry to the nearest office.

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Reg. U. S.
Pat. Off.



Also BAKER & ADAMSON, C. P. Acids, Laboratory Reagents and Fine Chemicals

The dollar you **spend** now
is worth \$1.50

The dollar you **save** now
is worth 75c



A LOT of people feel just now like the old Negro who came to the crossroads and saw one sign pointing to heaven and another sign pointing to hell. He shook his head and said to himself, "Ef Ah goes to Hebben, gotta fly all the while; ef Ah goes to Hell gotta jump all the while. Ah giss Ah'll jes' set here an' rest mahse'f."

BUT resting is rusting. This is true of dollars.

IF those of us who *have* money just *leave* it to *rest*—the wheels of industry keep on rusting. Wheat and cotton and corn keep on piling up in warehouses. Our neighbors keep on hunting for jobs that don't exist.

Now, it's wrong to spend our dollars foolishly, just for the sake of spending. But a lot of us are *saving* dollars foolishly—just for the sake of saving—without realizing that the dollar we save today has a decreased *earning* power compared with the dollar we saved in 1929. But the dollar we *spend* today is worth \$1.50 in value received.

MOST prices are way down—further down than they were even in 1921. Eggs and butter and flour and clothing and furniture are way down—and that means values are way *up*. This is the greatest *buying* time we'll see again for many years.

PRETTY soon, these prices are going to start up—some prices have already started up. When they do, we'll have to pay *more* for the things we need *right now*. We shall have lost the chance to get that new suit or dress or chair or bed or radio or automobile—at a bargain!

BESIDES, if we buy these things *now*, we'll put somebody to work who needs a job even worse than he needs charity. If we put him to work, he can buy the things *we* make or sell, and that will help *us*.

HARD times? Not if we harness our dollars and hitch them to the wagon, instead of leaving them in the stable.

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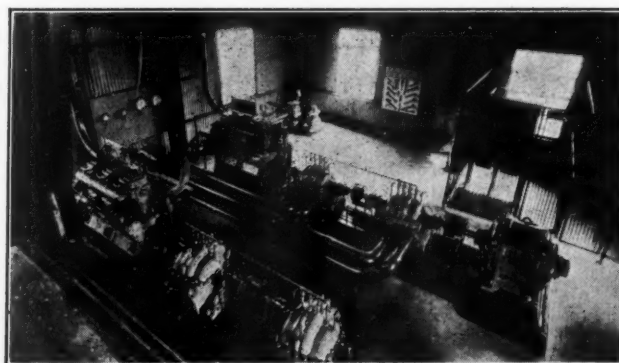
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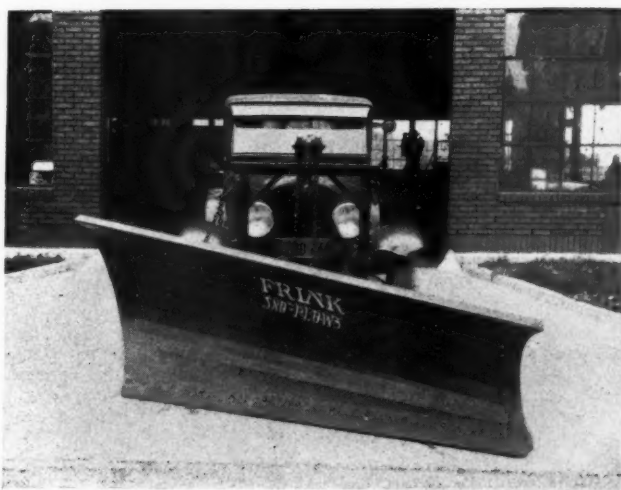
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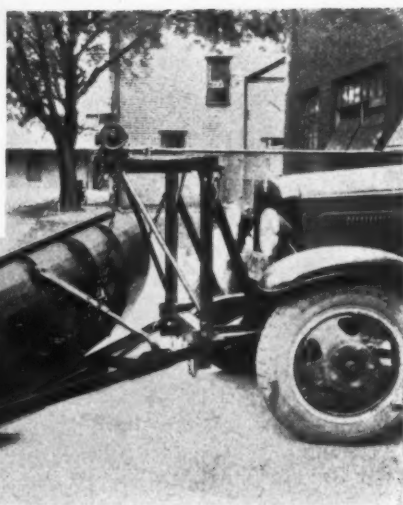
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